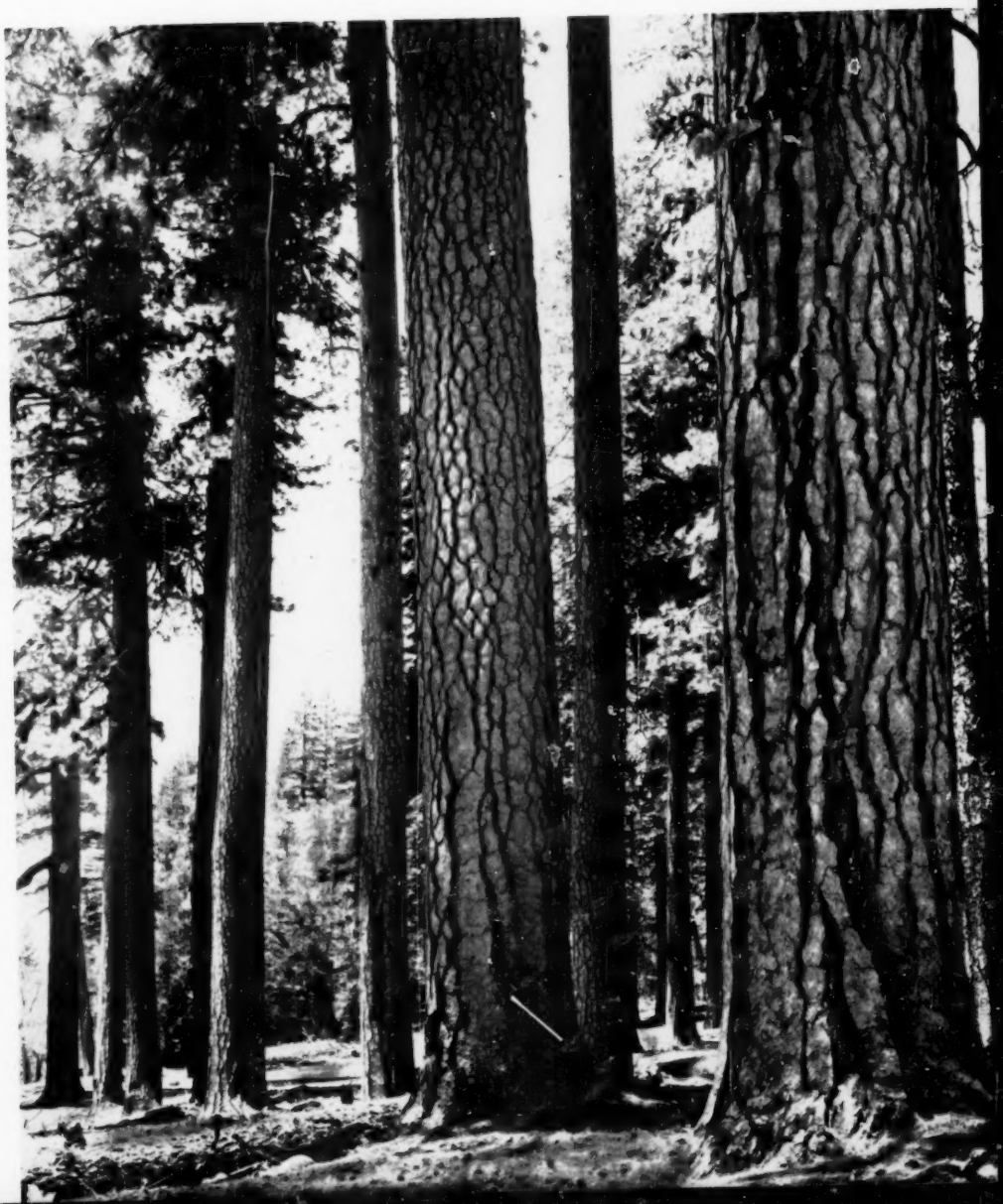
Journal of FORESTRY

JANUARY 1952



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Publication office, 825 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Address all correspondence concerning editorial or business matters to JOURNAL OF FORESTRY, 825 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Published monthly. Subscriptions $6 per year; single copies 60 cents. Missing numbers will be replaced without charge provided claim is made within thirty days after date of the following issue.

The editors are not responsible for loss or damage of manuscripts and photographs while in transit or in their possession. All material submitted for publication should be accompanied by return postage.

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Journal of Forestry

Official Organ of the Society of American Foresters

Just What is Conservation?[1]

Emanuel Fritz

Associate professor of forestry, University of California, Berkeley.

The author argues that conservation, to be meaningful, must be looked upon as wise use, frugality, and use without waste, and that it starts with the individual's wise use of his own resources—time, effort, and money. He believes that conservation is too frequently preached by those who are not guided by its basic principles in their own affairs and in the handling of public monies. He pleads for conservation teaching at its roots—frugality—to develop a race of citizens to whom all waste is abhorent and from whom a more frugal corps of public servants can be enlisted.

CONSERVATION, to most people, means solely the saving of *natural resources*. This is to be expected because conservation has been given an enormous amount of publicity centered on natural resources. If, at a busy street corner, one should ask 1,000 people, "What is Conservation?" my guess is that 75 percent would answer that it applies to forestry. That is because forest conservation publicity has been the most voluminous and has continued for the longest time—more than 75 years. They would be only partly correct. It is true that forestry *is* conservation, because forestry implies replenishment as trees are cut. But conservation applies not only to forests but to all other natural resources—oil, gas, ores, water, and soil. I would add also time, energy, effort, and money. The term when used alone should mean conservation in general, otherwise it should be qualified, as for example: soil conservation, water conservation, forest conservation, and money conservation.

That there should be confusion about conservation is understandable. For several generations the term has been dinned into our ears and too often it has been used carelessly and loosely. Often emotion and sentimentality played a big part in its preachment as well as in our reception. To many people conservation means locking up a resource. This is an all too prevalent understanding among forest and wildlife enthusiasts. Such exponents believe that our forests are too beautiful to cut or that they are too important for watershed or wildlife preservation. In forestry schools we occasionally enroll a student who expresses dismay when he learns that we teach *lumbering* as well as forest management and protection. It probably never occurred to him that lumber comes from trees and that to get it, trees must be cut. To other people, conservation means government ownership or, at least, government control. To them, public ownership is a magic cure-all for whatever they believe is wrong, or are told is wrong, in the handling of a resource. It does not occur to them that a public agency may have the same propensity for error, the same ambition, the same selfishness that we are told characterizes private individuals and business organizations.

Obviously many people do not think the same about conservation, or do not think it through. Why? Perhaps it reflects the power of continuous and persistent propaganda. Now, propaganda is actually a form of education, but as it is applied, it becomes a vehicle for spreading the author's doctrine and therefore may be highly colored. Conservation is "a natural" for the politician. Too many have ignored its import after their election.

Publicity about conservation is often of the scare type. It misleads many well-meaning people and makes violent enemies among those who own or operate natural resources, when they are branded as destroyers. But it also gains supporters who, knowing little about the subject, make ridiculous demands that put conservation in bad repute and retard its practice. Some of them are very poor conservationists in the true meaning of the word; others are crackpots and do the movement much harm. Others publicize conservation because they love to be regarded as crusaders. Many are out-and-out sentimentalists to whom the killing of a duck or a deer during the hunting season, or the cutting of a tree is abhorrent.

To me *conservation is wise use*. Just four words, but note that conservation involves *use*, and that the use must be *wise*. It is definitely not a locking up of any resource. Oil and ore in the ground are of no value to mankind until they are brought to the surface and converted into useful products. Idle soil contributes nothing until put

[1]Address given before the Kiwanis Club of Berkeley, Calif., March 6, 1951.

to work. Trees on the stump, except those in parks, are of little value until they are cut and converted into lumber, paper, or chemicals. Even for watershed protection, trees may not be as efficient as brush or grass. Locking up a resource denies us the contribution it might make toward a higher standard of living. Conversely, wasteful use, deprives us of full or continuous use and may lead to a lowered standard of living. Locking up, and wasteful use, are both wrong and both are opposed to conservation. So we can repeat that "Conservation is Wise Use;" or, "Use without Waste."

We can renew a crop of wheat each year. A forest can be cut and replaced with another. But ores and oils are not renewable. Water and soil are in between. There is a limit to the amount of water available and its supply varies with the precipitation cycles. Soil has its limits too and inevitably some of it is lost through use.

If we want to use our timber to its utmost, we must cut it wisely, defend it against fire, insects and diseases, and grow new tree crops. If we want the most from our nonrenewable ores and oils we must use what we have in the wisest manner with the least possible loss so that our natural supplies will last the longest possible time. If we want to use our water up to its limit, we must see to it that there is no impairment of such factors as soil cover, soil permeability, soil stability, and others that determine whether we have much or little of the rain and snow made available. If we want to get the biggest possible continuous crops from our soils, we must keep them fertile and lose the least through erosion.

Waste, abhorrent as it is, is not always completely avoidable. For example, when you squeeze the juice from your breakfast oranges you create a waste. The small amount of juice that you drink, weighs less than the rind and pulp you throw away. Yet it cost the grower as much to grow the rind as the juice. Every ton of ore you bring to the surface may require the movement and transport of more tons of earth. From the blast furnace you want only the iron; the slag must be thrown away unless it can be used somewhere as a fill. Every thousand board feet of lumber is accompanied by a large amount of waste. Because the tree is round and tapered, because the saws must cut their way into the log and thus create sawdust, and because you and I demand square-edged lumber of uniform widths with the least number of knots, much of the tree's contents cannot appear in the form of lumber. Yet the tree had to grow such unused material, plus branches, roots, bark, and leaves. We can reduce the loss with thin saws, by saving the best grades of lumber for the highest uses, and by using as low a grade as is economically feasible for the purpose. We often speak of lumbering as a wasteful industry, and it does look that way. We see only the stumps and unused material left on the ground. Yet what can be done about it? As long as lumber is needed, trees must be cut and some waste left. The amount of waste exceeds what can be currently used for pulp, or alcohol, or other derived products. As our western population increases and requires more paper products, and as technology improves methods of conversion of wood waste into synthetic boards and chemicals, we *will* use more and more of the unused material. We are already using a large part of our wastes in the great paper product and hardboard plants mushrooming in the West. But so far we can make only a large dent in the waste piles. We can of course, and should, convert a tree into lumber with the least possible waste. That becomes wise use. Now that timber is more expensive, more can be done along this line than heretofore, although there still remains the careless and inefficient operator and the one who has not the funds to buy the thin saws or who has not a sufficient output to make the closest utilization feasible. Unfortunately, a tree cannot be felled without creating a mess. Some people demand that the messy slash be burned. Yet, unless the slash is very heavy, it would be an advantage to let it lie and rot to protect the soil.

Wise use must take cognizance of economic laws. It would not be wise use, if, to save timber you would be forced to use boards too poor to serve your purpose. You may save *wood* but you waste on extra sawing, fitting, nailing, and gluing. That is an example where wise use must take into account all the chain of operations involved in ultimate use. If you say that the waste wood should be made into industrial alcohol you would be correct as to the possibility but you may be quite wrong as to its being wise use, because alcohol can be made more cheaply from other wastes. You can see from this that the consumer, by demanding the best and cheapest product, actually sets the standards the primary producer can employ. What is true of wood, is equally true of farm products, metals, textiles, and other products.

Some very good people believe that our past extravagant use of resources was, in large part, responsible for our rapid growth and our great national strength. These people have a really strong point that cannot be ignored. But let us not forget that we had exceptionally large resources, that we were also extravagant with our energies, and that the pace of the past cannot be kept up without some day paying the bill.

Conservation, to be meaningful, must be viewed in a much broader sense. We must not think in terms of water only, or of soil, or of ore, or of timber. Suppose we look at conservation right in our own homes and shops, then maybe the basic aspect of conservation will become more clear. If a housewife buys 4 quarts of milk when 3 would be enough, and if through carelessness she lets some of it spoil, she has not practiced conservation of milk, nor of her money. She has not made a wise purchase, nor put it to a wise use. If a storekeeper should install fixtures more elaborate than the profits of his business could justify, he would be wasteful of valuable materials where lesser ones would serve equally well. If a manufacturer

buys more lumber than he can use, and loses some of the surplus through decay, breakage, and insect attacks, he has wasted wood that the primary manufacturer perhaps made with a minimum of waste. If the clothing maker lays out his patterns carelessly and uses more yardage than is necessary, he has wasted not only cloth but the cost of weaving, dyeing, and handling the part wasted.

Conservation, as wise use, goes much farther than the wise use of natural resources. It concerns also time, energy, money, and effort. If you think of conservation in this fashion you might discover that the one who is most articulate about waste in someone else's business is himself not a conservationist at heart. To him *conservation* has become mainly *conversation*.

Conservation actually simmers down to *frugality*. If *frugality* is accepted as the basic concept or philosophy of conservation and if we practice it at home, in our office, our stores, our purchases and use of food and clothing, and the use of our money, time, and effort; if we will accept frugality as a guide in our daily life, we will have gone far to solve the conservation problem.

When you think of conservation as *frugality*, and analyze your own frugality you may find that maybe the conservation *you* have in mind is only the actions of the other fellow. Or, if you look into the frugality of those who are most articulate about conservation you may find some striking inconsistencies. For example: Here's a man, living far away from oil wells. He has heard that crude oil reserves are wastefully handled. He is not likely to examine further but to accept as a fact the charge that oil companies are so greedy for profits that they leave half the oil in the ground instead of pumping back gas pressure to force the last drop up. He doesn't know that that is already the practice of the principal oil companies. Yet, while he wants oil reserves used more efficiently, he may drive his own car in such an inefficient manner that it uses oil and gas at a greater rate than it should. His waste of oil and gas is more deplorable than waste at the wells, because he wasted not only a raw material—crude oil—but also the time, effort, and money expended to extract his gas from it.

In this day it is popular to decry bigness in industry. Yet bigness makes for the most complete and most economical use of resources. And how about the public official who makes his job bigger by propagandizing the public on the waste in this or that industry? Before you accept *his* arguments I suggest you inquire how *frugal* he is in spending your *tax* monies.

A few weeks ago there was held in Berkeley an excellent two-day conservation conference. Its main purpose was to arrive at ways and means of extending conservation philosophy into our educational system. The theory is that, if our school children are taught conservation they will practice it when they are older. It was a good conference and its motives commendable; its theory sound. In the past various groups have tried to get conservation taught in the schools according to their special interests. One wanted wildlife conservation taught as a separate course, another emphasized water, and another, forests. This would be piecemeal conservation education. Would it not be more effective to teach conservation as frugality and and thrift, wise use, use of anything without avoidable waste? Conservation should be taught at its roots. Perhaps a good place to start, one that affects everyone, is in the school kitchen where the youngsters could be taught the proper preparation of meals—how to prepare them to be savory and palatable, nutritious *and* economical. If, with cookery is combined a frugal use of materials, time, effort, and heat, the student learns not only the art but basic frugality as well. Americans are more wasteful by far of food than of any other commodity. What we throw away would keep our dependent nations in vigorous health. Anyone who must eat most of his meals in a miscellany of hotels and restaurants will agree that what this country needs most is better public cooks. We certainly do not practice conservation with our food supplies.

Whenever and wherever people have too much of anything, whether oil, ores, timber, water, or money, they are inclined to be wasteful. That has been our history. Frugality is ridiculed. Conservation is absent. The best conservationists, from the waste viewpoint, are those who have the least. Frugality is forced upon them by necessity.

To sum up: Conservation is wise use. Basically it is frugality. Conservation applies not only to one natural resource, but to all, and also to the use of time, effort, materials, and money. We will never reach perfection. We are not superhuman and we make mistakes. Conservation requires more effort than we like to expend. But we can at least make conscious and conscientious effort to improve. Perhaps if we are successful in teaching conservation as *wise use* and *frugality*, we might develop a race of citizens to whom all waste is abhorrent. And let us hope that from them we will get public servants who apply the principle of wise use and frugality to their expenditure of the taxpayer's money.

The Society of American Foresters and Forestry Education[1]

Myron Krueger

Professor of forestry, University of California, Berkeley; Chairman, Committee on Accrediting, S. A. F.

IN THE FALL OF 1950 the Society of American Foresters completed another examination of the forestry schools of the United States for purposes of accrediting. In keeping with previous examinations this has served again to focus the attention of professional foresters on the subject of forestry education. Therefore this seems an appropriate time to discuss what should be the complete responsibility of the Society of American Foresters to forestry education.

H. H. Chapman who contributed so much hard, effective work in initiating the accrediting process, has stated[2] that "the objective of accrediting was to determine one outstanding fact, namely, whether the instruction in the professional field of forestry was of a character calculated to equip graduates with sound basic training and knowledge adequate to permit them to develop competence as professional experts. . ." This statement enunciates what should be the very core of forestry education. Whether or not accrediting is or has been able to accomplish this objective fully, the mere application of the accrediting process is bound to improve forestry education. As one who has participated in accrediting for five years, I can say without fear of contradiction that the accrediting of the forestry schools represents a real contribution of our Society to the improvement of forestry education. Forestry education is in far better shape today than it would have been without the inauguration of the process of accrediting in 1933.

There is considerable doubt, however, that accrediting alone constitutes the full obligation of the Society to forestry education. In some respects accrediting is merely a stimulant. Some of the weaker institutions put up a sufficiently good front to be accredited, or then fail in their efforts for further improvement. Frequently this lack of further improvement is no fault of the faculty. At best accrediting can give emphasis only to minimum requirements. The thesis presented here is that the Society owes something more to forestry education than merely seeing to it that the weaker institutions keep just above the minimum requirements.

Article II of the Constitution of the Society is as follows: "The objects of this Society shall be to represent, advance, and protect the interests and standards of the profession of forestry, to provide a medium for exchange of professional thought, and to promote the science, and standards of forestry in America." Note the emphasis on promotion of science, and advancing standards. Professional education constitutes the very foundation of these objectives. Without continuous improvement in forestry education our profession cannot advance. Probably it could not even survive.

In all forest regions of the United States there is abundant evidence of the enormous increase in demands for technical forestry skill on the part of forest owners. One large forest owner of the Pacific Northwest, where virgin stands are still relatively plentiful, is employing two experts to classify the soils in his ownership. Many other examples could be given to show that forest owners everywhere are becoming concerned about how to grow forests of desired form more quickly. Are we of the schools measuring up to this responsibility. In my opinion, we are now in another transition phase of forestry; therefore, it is up to every school faculty to reexamine its own offerings in the light of this change in professional demands. But, in addition, we need the informed interest of all professional foresters.

In this problem of meeting new demands, accrediting cannot be of complete help. First of all, it is a periodic process. Secondly, the major emphasis is on minimum standards. Therefore, at best, the bases used for accrediting lag behind what is actually being done by the stronger forestry schools. During this transition period we need continuous study and discussion of forestry education; thorough study and discussion which will result in the crossing of new frontiers and in a strengthening of the professional qualifications of all graduates in forestry.

How the Society Can Help

There are three main ways in which the Society can function in the promotion and strengthening of professional forestry education:

1. By assisting prospective institutions to start off in strength. We still have a few areas in which new schools are likely to be established. We cannot prevent their establishment in the face of strong local desire, but we can present a strong picture of requirements in facilities, money, and staff if a worthwhile school is to result.

2. By assisting weak institutions to become stronger. We have not fulfilled our full duty as a Society by merely refusing to accredit an institution which display elements of weakness. We must remember these weak institutions are staffed by our own members. Therefore, we must do everything possible to assist such schools in removing their weaknesses.

3. By assisting all institutions to make advances in their offerings to meet the rising standards of the profession. Forestry is not static. The profession is right now charged with the dynamics of change. Forestry education must reflect this dynamic situation in the profession.

Just how can the Society operate to carry out these functions with reference to forestry educa-

[1]Presented at a meeting of the Division of Education, Society of American Foresters, Biloxi, Miss., December 12, 1951.

[2]Bases for Accrediting Schools of Forestry. Mimeo. Jan. 1947.

tion? The means of operating may be grouped under two main headings: (1) those which are direct and official, and (2) those which are indirect and somewhat unofficial.

Official Action

Accrediting is a good example of direct action by the Society through official representation. As has been pointed out earlier in this discussion, these official accrediting processes are periodic. There is the accompanying tendency not to keep attention focused on forestry education during the intervals between accrediting examinations. During the accrediting examination of 1950 the head of one forestry department offered the objection, and with some justification, that we had raised the standards of accrediting without sufficient warning to the schools. The Society has been remiss in not discussing forestry education sufficiently so that the inevitable changes in standards are apparent to all. Basically this means that we, every one of us, have been remiss in our professional obligations.

To focus more continuous attention on forestry education, perhaps the Committe on Accrediting could be reconstituted as a Committee for the Advancement of Forestry Education with the obligation of continuous study and discussion of the subject. However, there are many details in the techniques of conducting accrediting; details, which of themselves are of sufficient complexity to keep a Committee on Accrediting busy. So perhaps the obligation for continuous discussion of forestry education should rest with the Division of Education.

As will be pointed out in the subsequent paragraphs, we can function in forestry education as a Society only if our membership is well informed on the subject. Practically all the discussion on forestry education of the past few months in the JOURNAL OF FORESTRY has been confined to members engaged in teaching. This indicates a considerable lack of knowledge or lack of interest on the part of those members of the Society who are not engaged directly in forestry education. Vigorous yearly discussions in the Division of Education should be of some help in correcting this situation. This continuous discussion would be a healthy contribution to the advancement of forestry education and should provide a sounder basis for the periodic accrediting examinations of schools. With continuous discussion of forestry education, accrediting of the future would not be so largely the conclusions or opinions of a small committee.

Unofficial Action

It has always seemed to me that the Society has not been aware of its full potential to operate somewhat unofficially. To anyone who reads of the large number of our members who currently, each year, reach the age of retirement, it is apparent that we now have a good gradation of age classes. This means that in every forest region of the United States we have many members still in active professional work, who have become solid, substantial citizens of the communities in which they live. Why not use these members to bring about improvement or straighten out local difficulties in forestry education.

A number of years ago an internal fight developed in the faculty of one of our forestry schools. The fight finally reached the point where it was considered necessary to remove the school temporarily from the accredited list. In my opinion this was a somewhat unfortunate use of our accrediting function. The situation was apparent for a long time preceding the action of the Accrediting Committee. A great deal of hard feeling could have been avoided if a small committee of influential *local* members, acting at the suggestion of the Council but functioning largely as interested individuals, had stepped in and ironed things out while the fight was still merely a small-scale squabble.

There are still a few areas where there is local pressure to set up new forestry schools. Here too is an excellent field for influential local members to see to it that strength is one of the characteristics of the new school right from the start or, failing in that, to prevent the establishment of a weak school. It follows necessarily that every member must keep informed as to what the attributes of a strong school are.

In a not inconsiderable number of forestry schools, inadequate budgets constitute a real problem. The budget problem is becoming more acute with continuing inflation. Inadequate salaries are still characteristic of too many institutions of higher learning. Here too members of the Society, operating as just plain good citizens, can do much to assist in improving the situation. In all these problems, if the members function unofficially, the official, unified action of the Society can become more effective by being reserved for the larger problems affecting the profession.

In this paper the attempt has been made to show that forestry education is of vital concern to every professional forester, not just those engaged in teaching. The profession of forestry is now in a dynamic transition stage. Forestry education of necessity must meet the changing demands on professional foresters. For this purpose, continuous vigorous discussion is needed. In meeting this need, the Division of Education would do well to adopt the philosophy behind the advertising slogan of an automobile manufacturer of years gone by, "no yearly models but continuous improvement."

Aerial Survey of Spruce Budworm Damage in Maine in 1950

R. C. Heller, J. L. Bean, and J. W. Marsh

Respectively, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture, and Division of Entomology, Maine Forest Service, Augusta.

It has never been easy for entomologists to determine the extent and seriousness of forest insect damage. Roadless, inaccessible areas have always been extremely difficult to survey, and it has not always been possible to sample all infested areas satisfactorily from the ground. The advent of the airplane and its development, however, have made it possible to observe all forested areas, no matter how remote, and to determine insect conditions more accurately then had been done in the past.

FIRST USE of the airplane for surveying forest insect damage was in 1923, when F. C. Craighead made aerial observations of defoliation by the spruce budworm, *Choristoneura fumiferana* (Clem.), from an open-cockpit seaplane over heavily infested Canadian timber. Craighead found that he could distinguish defoliated timber by the grayish appearance of the terminal branches. More recently, airplane surveys have been successful in Washington and Oregon for delineating the heavy infestations of spruce budworm in those states.

The observations previously reported were made in areas heavily infested with the spruce budworm, leaving still to be determined the value of such observations in detecting areas of light feeding. Since 1949 many flights have been made over lightly infested forests in northern Maine, and trained observers have explored the possibilities of detecting these infestations from the air. They found that, with practice and frequent ground checks, spruce budworm defoliation as low as 15 percent of the current year's growth could be determined by noting the browning of the new growth of balsam fir. In fact, light budworm defoliation was easier to detect from the air than from the ground, because an aerial view of a balsam fir crown reveals more of the terminal branches on which the budworm feeds than does a ground view. This is particularly true in older stands, whose crowns form a a closed canopy, the lower branches of which obstruct the view of the new growth from the ground

The principal reason for recording the presence and extent of light infestations of the budworm is to provide a basis for determining trends in population intensities from year to year. Simply to record the centers of heavy infestation and ignore the light ones would restrict the control problem to the costly suppression of outbreaks. It would not permit the application of preventive measures prior to the development of an outbreak—a form of control that might prove considerably cheaper in the long run. To obtain the information needed as a basis for estimating changes in budworm populations, and to show their approach to dangerous levels, the feeding areas must be observed systematically from year to year, and the only satisfactory way to do this is to map them accurately.

In 1950 an effort was made to record from an airplane the presence and distribution of budworm infestation in the balsam fir forests of northern Maine. The plan finally selected was similar in many respects to a systematic line-strip timber cruise on the ground. The plane was flown along predetermined flight lines and the presence and degree of defoliation was noted by observers using an operation recorder. The survey was begun on June 28 and continued 2½ weeks.

Procedure

In general, the estimate of budworm defoliation was based on the appearance of balsam fir. Except in areas that showed the heaviest budworm defoliation, little damage to red and white spruce was apparent. The current growth of balsam fir that had been heavily fed upon had the following characteristic appearance from the air: (1) An orange-to-brownish color, particularly in the upper third of the crown; (2) a chewed and ragged appearance on the faster-growing trees; and (3) in some areas the presence of bare twigs, contrasting in color with the usual blue-green of uninfested trees.

From the experience gained in a reconnaissance aerial survey made in 1949, budworm defoliation on balsam fir was separated for recording purposes into the following three categories:

1. *No observed defoliation.*—Susceptible firs present, but no browning visible from the air.

2. *Scattered defoliation.*—Occasional individual firs, showing typical browning.

3. *Continuous defoliation*—All firs showing evidence of budworm feeding.

No attempt was made to separate trees or stands on which heavy or light budworm feeding occurred, the only records made being those showing the presence or absence of budworm feeding. Ground checks made during and following the aerial survey did, however, show that the observers detected defoliation as low as 15 percent of the current crop of foliage. (It should be remembered that in Maine budworm feeding is still restricted mostly to the removal of new growth, with very little feeding on older foliage.) In addition to the three categories of defoliation, records were also made of (1) continuous stands of hardwood, (2) open fields, and (3) large bodies of water.

A Cessna high-wing monoplane with no obstructing struts and capable of carrying five persons was used on the entire survey (Fig. 1). Of many types tested, this plane was found to be the one best suited for aerial surveying of insect damage. Lakes are more common than landing fields in Maine;

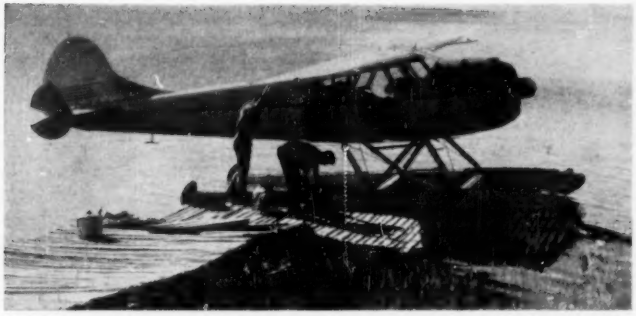

FIG. 1.—Cessna 195 airplane on floats, showing excellent visibility afforded observers by Plexiglas doors.

therefore floats were installed on the plane for maximum safety of personnel, and to permit entomologists to make ground observations in the vicinity of lakes in otherwise remote forested areas. Further modifications of the aircraft included full-length Plexiglas doors to give the observers maximum visibility.

Maine State highway maps with a scale of 1 inch = 2 miles were used. Individual maps covering the spruce-fir region were assembled and glued together to form a single large map. Smaller-scale maps were not available and those having larger scales were too bulky for the pilot to handle. Flight lines were drawn 3 miles apart from Canadian border to Canadian border in an east-west direction on the assembled map. (Outside the area of defoliation reported in 1949, flight lines were drawn 10 miles apart.) The assembled map carrying the superimposed flight lines was cut into strips 18 inches wide, parallel with the flight lines, to facilitate handling in the airplane. Along each flight line prominent landmarks, such as large streams, rivers, lakes, lookout towers, and roads, were marked and numbered consecutively. These points were used to simplify the preparation of the final map and to help correlate the airplane's ground speed with the chart speed of the operation recorder. To facilitate handling of the highway maps by the pilot, an aluminum board, 15 by 18 inches, was made. The map in current use was folded around this board prior to each day's flight, and by unwinding it the pilot could easily follow the flight lines.

A radio altimeter was installed in the airplane to assist the pilot in maintaining a constant altitude above the ground. By following the contour of the terrain as closely as possible with the altimeter the observers could view a swath of constant width. It was very important to know this width over a given length of flight line, in order to make a reliable estimate of the percent of coverage obtained.

Preliminary flights over known budworm infestations indicated that the observers could best discern the light defoliation at 200 feet above the ground and at an air speed of 90 to 95 miles per hour. The radio altimeter limit switch was set at 200 feet and the airplane was flown along each flight line by reference to the instrument. Over extremely rough terrain the plane was flown at a higher altitude, as a safety precaution; however, it was never above an altitude that prevented the observers from noting defoliation. The pilot's duty was to fly at a constant altitude the course lines drawn on the maps. Since all flying was conducted at 200 feet where possible, navigation was by reference to landmarks. A gyro compass assisted in maintaining the proper heading, once it was established. When the plane flew over the landmarks, which were numbered on the map, the pilot recorded the appropriate number in Morse code by using a keyboard connected with the operation recorder. The operation recorder (Fig. 2) permitted a correlation to be established between time and distance covered by the airplane, as compared with time and distance on the recorder chart. Thus, observations made from the moving airplane can be located and measured on the recorder chart and later transferred to a map.

The operation recorder used in these studies has 20 electrically actuated pens, which can be used individually or in combination with each other to make a record on a moving chart. The rate at which the chart moves past the pens can be set at a known speed, and is actuated by an accurate clockwork mechanism. In operation, when an observer's switch is held down, the electrical circuit is closed. This energizes the appropriate electro-magnet, which moves the pen across the chart. The chart speed used on the survey was 1½ inches per minute. The 12-volt, direct current power supply already embodied in the airplane was used as a power source for the recorder.

Two keyboards (Fig. 3) were constructed, each having a bank of six momentary switches. The keyboards were light in construction, weighing less than 1 pound and

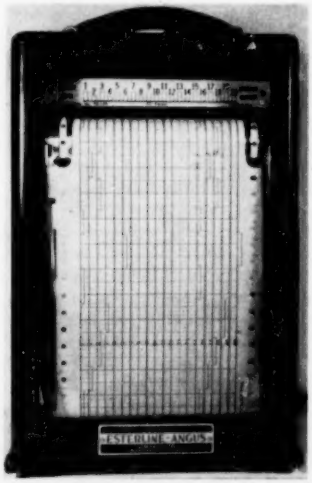

FIG. 2.—Pen operation recorder. Pens 1 to 6 are operated by observer on right side of plane; pens 15 to 20 by observer on left side of plane. Pen No. 10 is actuated by the pilot.

measuring approximately 4 by 8 inches. Each of the six switches was connected with the operation recorder and captioned according to the information required on the survey. After 15 minutes of indoctrination with the keyboards, an observer could keep his attention on the ground continuously and did not need to watch the location of his fingers for correct placement.

In flight, the two observers sat on the rear seat of the airplane. Each held an operation-recorder keyboard on his lap and recorded the budworm condition visible from his side of the plane, by holding down the appropriate switch. Holding at least one switch down at all times, but only one at a time, caused a continuous record of conditions on one side of the plane to appear on the recorder. Since each observer operated a separate keyboard, information on both sides of the plane was recorded simultaneously. This furnished maximum coverage along the flight lines and proved to be valuable in establishing infestation boundaries and in compiling the final map. Finally, as an added check on the airplane's ground speed, the flying time for each flight line was measured with a stop watch.

Distances on the flight map were scaled to the operation-recorder chart by using proportional dividers. Since the airplane's ground speed varied with the speed and direction of the wind and with the terrain flown, this method of establishing a ratio between landmarks (as marked on the recorder chart and numbered on the flight map) proved easiest to use and was the most accurate.

Three types of foliage discoloration resembling spruce budworm damage from the air are listed, as follows: (1) Frost damage. This is the most confusing of all discolorations likely to be encountered. The frost-killed tips of balsam-fir usually range in color from light pink to very red, and the needles are persistent on these tips. Fortunately, close observation will reveal that on budworm-defoliation trees the needles are either absent or ragged, and range in color from orange to brownish. (2) Defoliation by the black-headed budworm, *Acleris variana* (Fern.). When extremely large populations of this budworm are present its damage looks very much like that caused by the spruce budworm. Only by ground checks is it possible to differentiate damage caused by the two insects. (3) The presence of staminate flowers on balsam fir. These flowers are very similar in color to spruce budworm defoliation; but, fortunately, shortly after the 1950 studies were begun most of the staminate flowers had fallen and this difficulty was eliminated.

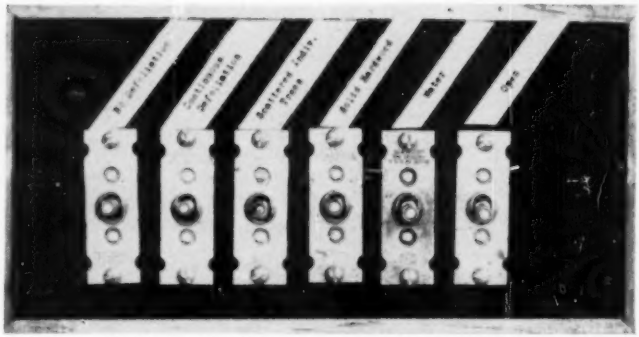

FIG. 3.—Electrical keyboard with six momentary switches connected with the operation recorder. "No defoliation" switches of right and left keyboards were connected with pens 1 and 15, respectively; "continuous defoliation" with pens 2 and 16; and the other switches with other pairs of pens.

As the survey progressed, frequent ground checks were made of known budworm infestations. The same areas were also checked from the air, which enabled the observers to note changes in color on budworm-defoliated trees. Ground checks made of areas showing unusually heavy browning were also used to distinguish between damage done by the spruce budworm and that done by the closely associated black-headed budworm. This distinction was accomplished by landing the plane on the nearest lake and hiking into the area on foot. Finally, occasional ground checks were made of areas where no defoliation was recorded by the observers, to see whether damage was present but not recorded.

FIG. 4.—Map showing extent and intensity of spruce budworm defoliation from 1950 aerial survey.

Results

From the information recorded on the operation-recorder charts, a final map showing the intensity of spruce budworm defoliation was drawn. A draftsman first established the ratio of the distance between two consecutive landmarks on the flight map to the distance between the identical landmarks on the recorder chart. The proportional dividers were used to determine this ratio quickly and accurately. Each observation from the recorder chart was thus easily transferred to the map and was given a respective color.

The limits of both the scattered and the continuous budworm defoliations were outlined on the flight map by reference to their respec-

tive colors. A smaller-scale map (Fig. 4), showing the locations of the flight lines and the limits of spruce budworm defoliation was then prepared. A subsequent egg-mass survey was planned on the basis of this map, and almost complete agreement of infested areas was reached in the findings of these two surveys.

The northern part of Maine was divided into three north-south sectors—*A*, *B*, and *C*—first, to simplify the flying; and second, to facilitate statistical analysis from the operation-recorder charts. The boundaries of these sectors were determined by physical features (Maine State Highway 11, Allagash River, and the international borders between Maine and Canada) and are shown on Figure 4 by dashed lines. Table 1 shows the distribution of spruce budworm defoliation as found by sectors and flight lines. A small amount of scattered defoliation was observed as far south as line 33. It was too slight to record on the map, but it does show up in Table 1.

The heaviest continuous defoliation occurred in Sector A in the most northerly group of flight lines (1 to 11). It is interesting to note that the spruce budworm defoliation decreased in each sector as the survey progressed southward.

To determine whether a smaller sample would decrease the accuracy of the survey, the flight lines over all sectors were divided into eight blocks consisting of four flight lines each. Two flight lines were picked at random from each block, and were weighted, and the standard error at the 95-percent-accuracy level was calculated. The percentage and their standard error of defoliation, with other recorded data are shown in the following tabulation. Each block contains four samples, two of which were drawn at random.

Continuous defoliation	3.4±1.7[1]
Scattered defoliation	21.0±2.1
No defoliation	50.3±3.7
Hardwoods	15.8±2.6
Water	3.1±0.6
Open	6.4±3.1
	100.0

[1]This value can be expected 19 out of 20 times, according to Fisher's tables of *t*.

It is obvious from the above data that, within the prescribed accuracy limits, one-half of the flight lines chosen at random would have given a reliable survey. However, it would have been very difficult to produce a map from flight lines chosen at random; therefore, it appears advisable to continue making systematic strip surveys.

TABLE 1.—BALSAM FIR DEFOLIATION BY THE SPRUCE BUDWORM AS RECORDED BY AERIAL OBSERVERS IN NORTHERN MAINE IN 1950

Areas represented by flight lines	Percent of spruce fir type— Defoliated Continuous	Defoliated Scattered	Not defoliated
Sector A—Northeastern Maine			
1-11	29	47	24
12-22	3	23	74
23-33	0	2	98
Sector B—North central Maine			
1-11	12	65	23
12-22	5	38	57
23-33	0	0	100
Sector C—Northwestern Maine			
1-11	6	60	34
12-22	1	23	76
23-33	0	3	97

Summary and Conclusions

1. Light defoliation of balsam fir (as low as 15 percent of current growth) by the spruce budworm was detectable from an airplane flying 200 feet above the ground at 90 to 100 miles per hour.

2. A systematic line-strip aerial survey was laid out to cover spruce-budworm-susceptible timber in northern Maine. Less intensive sampling was conducted in areas beyond observable defoliation.

3. An operation recorder was used to transcribe instantaneously to a moving chart the aerial observations of two forest entomologists.

4. A map showing the extent and locations of spruce budworm damage was prepared from the operation-recorder charts. A statistical analysis showing budworm defoliation in percentages of area surveyed was also made from these charts.

5. Many ground checks were made in remote areas to collect spruce budworms and to check on the accuracy of the observers.

Approximately 10 million acres of northern Maine were surveyed by air for spruce budworm damage in 2½ weeks, and 4½ million acres were found to have continuous and scattered budworm defoliation. The survey required 44 hours of flight time, 22 hours of which were spent on the flight lines. Ferry time and transportation of personnel to make ground checks in remote areas accounted for the rest of the flight time. One pilot, two entomological observers, and one draftsman were used to carry out the survey.

This method fulfilled the requirements of a good forest-insect survey, since it produced accurate information on budworm conditions with a minimum expenditure of funds and with a minimum of personnel. Ground surveys alone could not cover an area of this size so effectively, so cheaply, or in so little time. The annual progress of the spruce budworm damage can be followed readily by the aerial survey. Its flexibility permits future control and survey programs to be made intelligently and with a high degree of accuracy.

Optimum Stocking of a Selection Forest

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In installing a many-aged or all-aged silvicultural system, the forest manager typically starts with an understocked stand of timber. One of his objectives, therefore, is to build up the growing stock. He does this by harvesting only a part of the growth, leaving the rest to accumulate. How far should he increase the timber volume? At what point may he look forward to cutting the whole growth rather than reserving any more of it? In other words, what is the optimum stocking?

THIS PAPER OFFERS a method for determining the optimum timber stocking of a selection forest. The method is simple in concept, but its application to specific forest conditions or stands may be difficult because of the dearth of reliable information—first, on timber growth as related to stand characteristics, and second, on timber value as related to density and size. However, even in the absence of fully dependable basic data, the method may be followed to get approximate but usable answers. It is therefore presented with two purposes in view. The first is to encourage sound calculations of at least tentative or interim stocking goals for specific selection forests. The second purpose is to reveal what kinds of information need to be collected in order to make more exact calculations.

An Approach to the Question

Optimum stocking is here defined as that quantity of timber growing stock which permits the maximum net return to the business per unit of time. By net return is meant the difference between all revenues and all costs, including as costs those of capital as well as of labor and land.

Net return so defined is maximized at the point where any small additional outlays for labor or supplies or other agents of production are just paid for by resulting increases in product. Take, for the moment, an example in the field of logging. In bucking logs from a felled tree, successive logs will be taken from the stem so long as the cost specially incurred in cutting off the log and limbing it is no more than the value of the resulting log. Every such log adds to the net income of the firm. But when the point is reached where the next log on up the stem is worth less than the direct cost of making it, then that is the place to stop. The additional log would add nothing to the net income of the business. So far as this tree is concerned, net income is now maximized.

The special or direct cost of making an additional unit of product such as a log will here be called the *marginal cost*. And the value of the resulting unit of product will be called the *marginal revenue*. Then the general principle emerges, that the net income of the firm is greatest at the point where marginal cost and marginal revenue are equal.

In what follows, the problem of determining optimum stocking (i.e., of determining the optimum point at which to stop building up the growing stock) will be approached in the same way as the problem of determining the optimum point at which to stop taking logs from a felled tree: An effort will be made to identify that point where the special cost of holding any extra growing stock (the marginal cost) is just equal to the revenue from the extra growing stock (the marginal revenue).

Determining Optimum Stocking

First, by way of illustration, a highly simplified imaginary model will be set up. Table 1 tests volumes per acre ranging from 4,000 to 16,000 board feet in steps of 2,000 board feet. It is assumed (for this simplified illustration only) that all growing stock has a value of 10 dollars per M board feet, and the same assumption is made concerning the growth, which ranges from 300 to 640 board feet per acre per year.

What is the optimum stocking of this imaginary forest in terms of board feet per acre? Suppose that the owner is building up the stand. He wants to know where to halt this process—where to stop adding to his investment in timber capital. The problem is to determine at what point the marginal revenue from his capital equals its marginal cost. Suppose that the marginal cost of capital to him is 4 percent: this is the net rate of return obtainable from alternative investments of equal risk. The question then becomes, at what point does the marginal revenue from the timber capital, in the form of growth, equal 4 percent?

As the volume of timber is built up from 4 to 6 thousand board feet per acre (Col. 1), the investment in timber capital is increased from \$40 to \$60 (Col. 2)—i.e., the marginal capital, or marginal value of the stand, is \$20 (Col. 5). At the

TABLE 1.—DETERMINING OPTIMUM STOCKING: AN IMAGINARY ACRE OF SELECTION FOREST AS A MODEL

Volume (M bd. ft.)	Current value	Current annual value growth		Marginal value	Marginal value growth	
1	2	3	4	5	6	7
	Dollars	*Dollars*	*Percent*	*Dollars*	*Dollars*	*Percent*
4	40	3.00	7.50			
6	60	4.20	7.00	20	1.20	6.0
8	80	5.00	6.25	20	0.80	4.0
10	100	5.60	5.60	20	0.60	3.0
12	120	6.00	5.00	20	0.40	2.0
14	140	6.30	4.50	20	0.30	1.5
16	160	6.40	4.00	20	0.10	0.5

same time, the current annual growth in value rises from $3 to $4.20 (Col. 3), so that the marginal growth, the difference between these two values, is $1.20 (Col. 6), or 6 percent of the $20 marginal value (Col. 7). This 6 percent is the marginal revenue from the timber capital. It is greater than the marginal cost of 4 percent, indicating that the process of building up the stocking must be continued further before the optimum will be reached.

What will happen to the marginal growth if the stocking is built up by another 2,000 board feet—to 8,000 per acre? Again the marginal capital is $20. The marginal growth is the difference between $4.20 and $5, or 80 cents, so that the marginal revenue from the timber capital is 4 percent, the same as the marginal cost. Optimum stocking, then, has been reached—at 8,000 board feet per acre.

It is important to emphasize the distinction between the *marginal* revenue and the *average* revenue from the timber capital—i.e., between the marginal growth and the current annual growth. Why should a stand of 8,000 board feet be optimum at 4 percent when the stand is still earning over 6 percent in current growth (Col. 4)? The reason is that although the growing stock *as a whole* is earning over 6 percent, the last *additions* to the growing stock are earning only 4 percent, and it is with respect to these additions, not the whole growing stock, that there is a question whether to retain them or liquidate them. This fact may be illustrated by an example.

Suppose that the owner takes current growth as his guide to stocking and hence builds up his stand to 16,000 board feet where current growth is 4 percent. His resources then will earn $6.40 per acre per year (Col. 3). That his income is not maximized under this set-up is seen in the fact that he could liquidate 8,000 board feet of growing stock, reinvest the $80 proceeds at 4 percent ($3.20 per year), and still make $5 on the remaining 8,000 board feet of growing stock—a total annual earning of $8.20. It can be shown similarly that no stand either above or below 8,000 board feet is more profitable than a stand of 8,000.

The point made here is that in estimating the optimum stocking of a forest operated for profit, one should use as a guide, not the current annual growth, but a somewhat novel concept, the marginal growth. This approach to the optimum-stocking problem will be called the *marginal growth method*.

If the test used just above is applied to the stand of 6,000 board feet in Table 1, this stand will appear to be equally as profitable as the one chosen for optimum. The reason for this is that Table 1 considers only intervals of 2,000 board feet. Indeed, the wide intervals used in this model can now be seen to have had a marked and arbitrary effect on the result, for the problem of determining the optimum is essentially a problem in calculus, involving infinitely small intervals. All such effect can be eliminated simply by plotting and curving the growth after tabulating it. This approach will now be followed in presenting a realistic example of the use of the marginal-growth method.

Use of the Marginal-Growth Method

The problem of determining optimum stocking is only one part of the whole problem of deciding wisely among management alternatives. Here, however, in order to concentrate attention on the question of optimum stocking, it will be assumed that the forest manager has already determined the best species and qualities and the maximum size of tree to grow, the best diameter distribution to maintain, and the best utilization of trees harvested. His interest now is in the optimum stocking.

Take a many-aged stand of loblolly and shortleaf pines on a good site. This stand is managed on a 5-year cutting cycle. At the beginning of the cycle (i.e., immediately after cutting) the stand contains all tree sizes below 24 inches d.b.h., which represents average financial maturity; and the number of trees in each 2-inch d.b.h. class is about 1.2 times the number in the next larger class, this being the optimum diameter distribution accepted for the stand. Diameter growth of merchantable trees during the cutting cycle will depend on initial stocking, and is estimated to be 2.0 inches in 5 years for a stand of 5,000 board feet per acre, and 0.1 inch less for each additional 1,000 per acre. The trees are harvested exclusively for sawlogs. The alternative rate of return, determined in this case by other available investments of equal risk, is 4.0 percent. What is the optimum stocking?

TABLE 2.—BASIC PER-ACRE VOLUME VALUE, AND GROWTH DATA FOR DETERMINING OPTIMUM STOCKING OF A LOBLOLLY-SHORTLEAF PINE STAND ON GOOD SITE

Volume		Value		Current value growth
Now	After 5 years	Now	After 5 years	
1	2	3	4	5
Bd. ft. Int'l. ¼"		*Dollars*		
5,000	7,340	210.00	317.30	107.30
6,000	8,670	257.30	382.30	125.00
7,000	9,960	306.50	447.50	141.00
8,000	11,190	357.40	512.70	155.30
9,000	12,380	410.10	577.80	167.70
10,000	13,520	464.70	642.80	178.10
11,000	14,610	521.00	707.30	186.30

Basic data for determining optimum stocking in this pine stand are given in Table 2. Stocking (at the beginning of the cutting cycle) ranging from 5,000 to 11,000 board feet per acre is investigated (Col. 1).[1] The volume of the stand at each level of stocking is projected ahead for 5 years, to the end of the cycle (Col. 2), using the growth rates given above and assuming that mortality losses of timber that cannot be salvaged are insignificant.

In Column 3, values per unit are applied to the volumes of Column 1. These values are weighted averages of the values of the different diameters of trees in the stand, and since only one diameter distribution is being tested, the averages tend from this standpoint to be the same at all levels of stocking. However, they vary because of the increase in timber quality with stock-

[1] In all the examples given here, the board foot is taken as the unit of measure. In general, however, any units of measure may be used in optimum-stocking calculations. Ordinarily the form of utilization will govern the choice of units.

ing, ranging from $42 per thousand at 5,000 board feet per acre to about $47.40 at 11,000. These are not stumpage values nor realization values; in light of the fact that overhead costs have no bearing on optimum stocking (a point discussed more fully below), these values have been computed simply by subtracting direct costs of production from the sales values of lumber realizable at the forest owner's sawmill.[2] Column 4 is similarly based on column 2, the values per thousand in this case ranging from about $43.20 to about $48.40, reflecting the higher average diameter of the timber stand at the end of the cutting cycle. Finally Column 5, the growth in value over the 5-year cycle, is the difference between the two preceding columns.

There now remains to determine the marginal value growth percent. This is done in Figure 1. Current 5-year value growth from Table 2 is plotted and curved over value (and board-foot stocking) per acre at the beginning of the cutting cycle. From this curve of current value growth a curve of marginal value growth percent is derived as illustrated by the triangle in the upper-right corner of the figure. This illustration shows the determination of marginal value growth percent for a stand of 10,200 board feet ($475) per acre. A straightedge is laid tangent to the curve at this point. The slope of this straightedge is found to be $15.90 per $100—i.e., 15.90 percent. This is the marginal value growth percent on a 5-year basis; it is converted to an annual basis with the help of compound-interest tables, which show the annual percent to be 3.0. In this same manner, marginal value growth percent is determined for enough other levels of stocking so that a curve may be drawn. It can be seen that this method of deriving the marginal value growth percent is precisely analogous to the method used to derive it in Table 1. The method of curving merely eliminates errors arising from the use of arbitrary intervals of stocking.

Optimum stocking may now be read from the curve of marginal value growth percent. In the present example, since the alternative rate of return is 4 percent, optimum stocking is 8,930 board feet per acre, International $\frac{1}{4}$-inch rule—say, 9,000 per acre—at the beginning of the cutting cycle.

A more detailed view of this optimum stand is afforded by Table 3. For convenience, the stand table is represented as being terminated abruptly at the upper diameter limits; in actual use, however, the limits would be flexible. Stocking at the end of the 5-year cutting cycle is about 12,400 board feet.

Consequently, over the cutting cycle, average growing stock per acre is about 10,700 board feet, International rule.

Reasoning Behind the Method

The owner of a selection forest bearing merchantable timber has open to him three general alternatives with respect to the volume of growing stock: he can increase it, hold it about constant, or reduce it. In increasing the growing stock, he will retain current growth as capital. In maintaining the growing stock, he will take the current growth as income, making it available for investment elsewhere or for spending. In reducing grow-

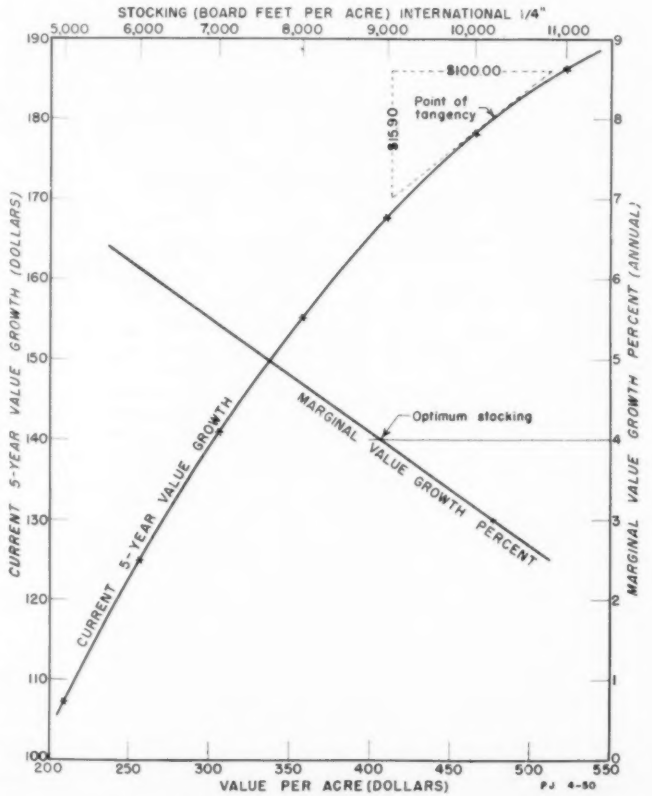

FIG. 1.—Derivation of marginal value growth percent and determination of optimum stocking (at beginning of a 5-year cutting cycle) for a loblolly-shortleaf pine stand on good site.

[2] The result of this subtraction is more accurately termed "conversion surplus." See Guttenberg, Sam, and William A. Duerr, *A guide to profitable tree utilization*. Southern Forest Exp. Sta. Occasional Paper 114, Nov. 1949.

TABLE 3.—NUMBER OF TREES, BASAL AREA, AND VOLUME PER ACRE BY TREE-DIAMETER CLASS IN AN OPTIMUM-STOCKED LOBLOLLY-SHORTLEAF PINE STAND ON GOOD SITE AT THE BEGINNING AND END OF A 5-YEAR CUTTING CYCLE

Tree diameter breast high	Trees		Basal area		Volume	
	Beginning	End	Beginning	End	Beginning	End
Inches	*Number*		*Square feet*		*Bd. ft. Int'l. ¼"*	
10	9.8	11.3	5.3	6.2	500	580
12	8.1	9.4	6.4	7.4	800	930
14	6.8	7.9	7.2	8.4	1,110	1,290
16	5.6	6.6	7.9	9.2	1,350	1,560
18	4.7	5.5	8.3	9.6	1,580	1,840
20	3.9	4.5	8.6	9.9	1,750	2,030
22	3.3	3.8	8.6	10.0	1,910	2,210
24		2.6	—	8.2		1,940
All	42.2	51.6	52.3	68.9	9,000	12,380

ing stock, he will not only take the current growth but liquidate capital as well, and the proceeds will, as above, be available for investment or spending. Spending may take such forms as direct personal consumption by the individual owner, payment of dividends by a corporation, or payment of current business expenses.

The funds obtainable by harvesting growth or liquidating growing stock have a value for investment or spending, often rather well defined, and usually expressible in terms of a kind of interest rate—i.e., a premium on current funds as against future dollars. For instance, in the case of investment, this premium may be determined by the prospective rate of return on new forest land, on planting or other cultural measures, or simply on the bonds of some borrower in or out of forestry enterprise. For spending, too, the return available from funds is, in general, expressible. For example, the cost of borrowing tends to determine the premium on funds for meeting business expenses, and individual time preference is similarly determinative in personal consumption. In any case there is some rate that expresses the potential net return on resources if, as an alternative to building up the growing stock, they are liquidated and put to other uses. This rate is the *alternative rate of return*. It represents the marginal cost of timber capital, being in effect the opportunity cost of holding such capital. In determining the alternative rate of return, there are three noteworthy considerations:

1. Where the rate is based upon the net return from alternative investments, this return must be estimated after income taxes, since funds derived from reinvestment of liquidated timber capital are subject to one more income taxing than are funds taken directly from the timber capital.

2. Where there is more than one alternative rate of return, the highest rate governs.

3. Where the alternative use of funds involves a different degree of risk than is involved in the growing-stock investment, the alternative rate of return must be adjusted to terms of equal risk.

The forest manager's three choices—to increase, maintain, or reduce the growing stock—resolve themselves into the choice between reinvesting resources in the form of this growing stock and using the resources elsewhere. To maximize net returns, he should make the choice which yields the higher income. If another dollar's worth of timber increment reinvested in the growing stock will increase the current value growth of the stand by a greater amount than the dollar would earn elsewhere, then it had best be reinvested, and so with all succeeding dollars that earn more as growing stock. That is to say, the growing stock should be increased so long as the *marginal value growth percent* (marginal revenue from timber capital) exceeds the alternative rate of return. Conversely, if the marginal percent is less than the alternative rate, some of the growing stock should be liquidated. It follows that the optimum growing stock is that whose marginal value growth percent equals the alternative rate of return.

Factors Affecting Optimum Stocking

The factors determining optimum stocking of a many-aged stand may conveniently be grouped into four: (1) The rate of growth; (2) timber value per unit of volume, in relation to tree stocking and size; (3) timber-growing costs in stands of different densities of stocking. These three factors control the marginal value growth percent. The other factor is (4) the alternative rate of return.

1. Optimum stocking increases with the rate of growth—or, more precisely, it increases in proportion to the increase in current annual growth that accompanies a given increase in stocking (that is, the marginal growth). Consequently, optimum stocking is raised by any factors associated with higher growth, such as better site conditions, lower mortality, or more productive stand composition as to species, diameter distribution, crown arrangement, and the like.

2. The greater the relative value per unit of volume—of timber of a given stocking as compared with timber of a given lighter stocking, or of trees of a given size as compared with trees of a given smaller size—the higher the optimum stocking.

Value per unit in relation to stocking exerts its influence on the optimum by changing the marginal value growth percent relative to the current value growth percent. In Table 1, value per unit was taken as $10 per thousand feet regardless of stocking. If value per unit were taken as $10 for a stand of 4,000 board feet and increased $1 per thousand for every thousand board feet above 4,000 then the stand of 8,000 would have a marginal value growth percent of about 4.9; the stand of 10,000, about 4.1; and the stand of 12,000, about 3.3. This would put the optimum close to 10,000 instead of 8,000.

Value per unit in relation to tree size exerts its influence on optimum stocking through its effect upon the value of the growth per unit in comparison with the value of the growing stock per unit—that is, by changing the current value growth percent and the marginal value growth percent in like proportion. In Table 1, the ratio of the value of growth per thousand to the value of growing stock per

thousand was taken as 1 to 1. If this ratio were taken as 2 to 1, the optimum stocking would be 12,000 board feet instead of 8,000. It can be seen that doubling this ratio has the same effect as doubling the rate of growth.

3. Any timber-growing costs that increase with stocking make for a lower optimum than would otherwise obtain. In Table 1, if property taxes increased 5 cents per acre for every 1,000 of stocking above 4,000 per acre, this fact could be introduced into the problem by scaling down the current value growth accordingly. Marginal value growth would then be 5.5 percent at 6,000 per acre and 3.5 percent at 8,000, shifting the optimum stocking to below 8,000 board feet per acre. The optimum in Figure 1 would similarly be affected if timber-growing costs varied with stocking.

4. The lower the alternative rate of return, the greater the optimum stocking. In Table 1, an alternative rate of 3 percent would mean an optimum of 10,000 board feet; a rate of 2 percent, an optimum of 12,000.

No factor other than those included in the four mentioned has any effect on optimum stocking. For example, the initial volume of growing stock, or the current volume, has no effect. Nor does the value of the land, the amount of property taxes if fixed per acre, or any other fixed or overhead cost of timber growing or processing. Finally, the price level and variable conversion costs of timber products have no effect on optimum stocking, assuming they do not influence the relative values per unit of timber of different size and stocking. This assumption is reasonably sound for the many cases where it can be demonstrated that prices and variable unit costs of different grades of a timber product bear a fairly constant percentage relation to one another over the course of secular increases in timber value and over the ups and downs of the market. The forest owner who can predict the ups and downs of the market with sufficient accuracy can in some cases increase his net returns by cutting his timber more heavily during the ups, less heavily during the downs. However, his optimum growing stock, in the longer-run sense and in the sense of a goal for forest development, remains unaffected.

The fact that the more variable factors have little bearing on optimum stocking of a many-aged stand, while the factors that do have bearing are relatively stable, means that estimates of optimum stocking have some continuing validity and thus in many cases need not be frequently revised. It means, too, that estimates made for a given forest type and site may be good for numerous forest properties.

It is interesting to observe that since value per unit in relation to tree size and stocking is a determining factor, optimum stocking is likely to be affected by whether the timber-growing enterprise is integrated with a timber-processing enterprise in the same business. If, for example, the woods owner who operates a sawmill and sells lumber is able thereby to get a higher market premium for quality material than the owner who sells stumpage, then the former owner can profitably carry a heavier growing stock than the latter. For the small woodland owner who depends upon the open stumpage market for his outlet, this fact and the fact that his alternative rate of return is ordinarily high go far to explain the tendency to carry but a meager growing stock.

Conclusion

A method has been presented for calculating the optimum stocking of selection forests. Optimum stocking, defined as that which will permit the greatest net return to the business, is determined at the point where marginal value growth percent equals the alternative rate of return. This point is readily derived from a curve of current growth in value over the quantity and value of the growing stock.

To make best use of the marginal-growth method, the forest manager should have available for his stands reliable information on current growth and timber values as related to stocking. However, where such information is not yet available, estimates of growth and value may be employed to derive a useful approximation of the optimum stocking.

Harvard University announces the Richard Thornton Fisher Research Fellowships designed to encourage study and research in silviculture. Three fellowships with fixed stipends of $2,000 each are available. They are to defray the expenses of tuition, living, and incidental travel for a period of approximately 15 months. The fellowships will enable students to matriculate in the Harvard Graduate School of Arts and Sciences, and to work in residence toward a master's degree in forestry, or toward a doctor's degree in biology with particular reference to silvicultural problems.

The fellowships are open to those who hold bachelor's degrees from undergraduate schools of forestry or from colleges of liberal arts. Graduates of the latter schools must have majored in biological science.

Applications must be filed with the Graduate School of Arts and Sciences, 24 Quincy St., Cambridge 38, Massachusetts by March 1. Further information and application blanks may be obtained from the office of the Graduate School or from the Director of the Harvard Forest, Petersham, Massachusetts.

The Most Efficient Size and Shape of Plot to Use for Cruising in Old-Growth Douglas-Fir Timber

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A STUDY CONDUCTED in an old-growth Douglas-fir stand in Oregon has indicated that a 1-chain by 3-chain (3/10-acre) rectangular plot is the most efficient size and shape of sample plot to use for intensive cruise work in old-growth Douglas-fir timber. This conclusion was reached after 12 different kinds of plots were tested.

In general, rectangular plots were more efficient than circular plots, and plots 1/5-acre to 1/3-acre in size were more efficient than either larger or smaller ones. Among circular plots alone, the 1/4-acre size was found to be most efficient.

This information on the relative efficiencies of various kinds of plots should be looked upon only as evidence and not as proof. The findings could differ considerably in other forest types where the number of stems per acre, tree size, brush cover, and other factors are different. It should also be noted that if cruising techniques other than those used for this study were adopted, the order of the relative efficiencies of the various kinds of plots might have been altered. However, the cruising conditions were quite typical for the Douglas-fir subregion of Oregon and Washington, and the techniques employed were standard ones used in cruising national forest timber.

The general purpose of this study was to increase the effectiveness of intensive cruise work in old-growth Douglas-fir timber. A more specific purpose and the subject of this report was to determine which of several kinds of plots is the most efficient to use in cruising old-growth Douglas-fir timber.

The Study Area

A 40-acre tract of old-growth Douglas-fir timber on the Blue River Experimental Forest within the Willamette National Forest in Lane County, Oregon, was selected for the study. This area lies about 50 miles east of Eugene and just north of the McKenzie River. The topography on the 40 acres varied from level to steep, and the ground was relatively free of brush. The average volume per acre for all species was 91,000 board feet. Except for a small amount of hemlock, sugar pine, and cedar, the volume was almost entirely in Douglas-fir trees which had an average diameter of about 45 inches.

Basic Data

Two kinds of data were obtained for the study:

1. *Cruising time data* — Two time studies were conducted on the 40-acre study area. One of these time studies was made to determine the average time required per chain of travel between plot boundaries. A two-man crew traveling 40 chains over various degrees of slope and using the staff compass and trailer tape was used for this study. The average time per chain of such travel was 1.84 minutes.

The other time study resulted in averages of the times required to take ten kinds of plots (Table 1). For this second time study there were ten lines of plots, each line containing all the plots listed in Table 1. The different kinds of plots were located at random within each line.

The average times required for two additional plots, the circular 1/4-acre and the circular 1/5-acre plots, were obtained from the data of the other circular plots by curving plot time over plot area. These averages were 10.6 minutes for the circular 1/4-acre plot and 8.8 minutes for the circular 1/5-acre plot.

TABLE 1.—AVERAGE CRUISING TIME REQUIRED ON PLOTS OF VARIOUS KINDS

Kind of plot	Average time required on one plot
	Minutes
Circular .100-acre	5.413
Circular .225-acre	9.663
Circular .400-acre	16.083
Rectangular 1/2-chain by 1-chain	2.360
Rectangular 1/2-chain by 2-chain	5.369
Rectangular 1/2-chain by 4-chain	10.224
Rectangular 1/2-chain by 6-chain	15.837
Rectangular 1-chain by 2-chain	8.202
Rectangular 1-chain by 3-chain	11.582
Rectangular 1-chain by 4-chain	16.840

Less time was required on the average to cruise the 1-chain by 2-chain rectangular plot than the 1/2-chain by 4-chain plot, although both kinds of plots have the same area. Apparently a compact rectangular plot is more efficient from the standpoint of cruising time than a longer and narrower rectangular plot.

Similarly it took less time to cruise 3/10-acre in the form of a 1-chain by 3-chain plot than in the form of a 1/2-chain by 6-chain plot.

2. *Coefficients of variation.* — The 40-acre study area was divided into 1600 square 1/40-acre units (1/2-chain by 1/2-chain) by stretching string along compass lines in the woods. A 100-percent cruise was then made to determine the total net saw-timber volume[2] in each of the 1600 units (Fig. 1). Later, in the office, the volumes on the 1/40-acre units were combined in ten different ways (Fig. 2) to provide ten different universes of plots.

For example, they were combined by twos to provide a universe of 800 rectangular plots (1/2-chain by 1-chain), and they were combined by fours to provide a universe of 400 square 1/10-acre plots. Ten coefficients of variation,[3] one for each of the ten universes of plots, were then calculated (Table 2).

It will be noted that the coefficients of variation listed in Table 2 are for rectangular and circular

[1] Field work by Otto Hanel and Roy A. Silen.

[2] This is the so-called "woods" net. It excludes volume in live cull trees and the cull logs of merchantable saw-timber trees. It includes all other volume in merchantable saw-timber trees which are 12 inches d.b.h. and over.

[3] Standard deviation divided by average plot volume.

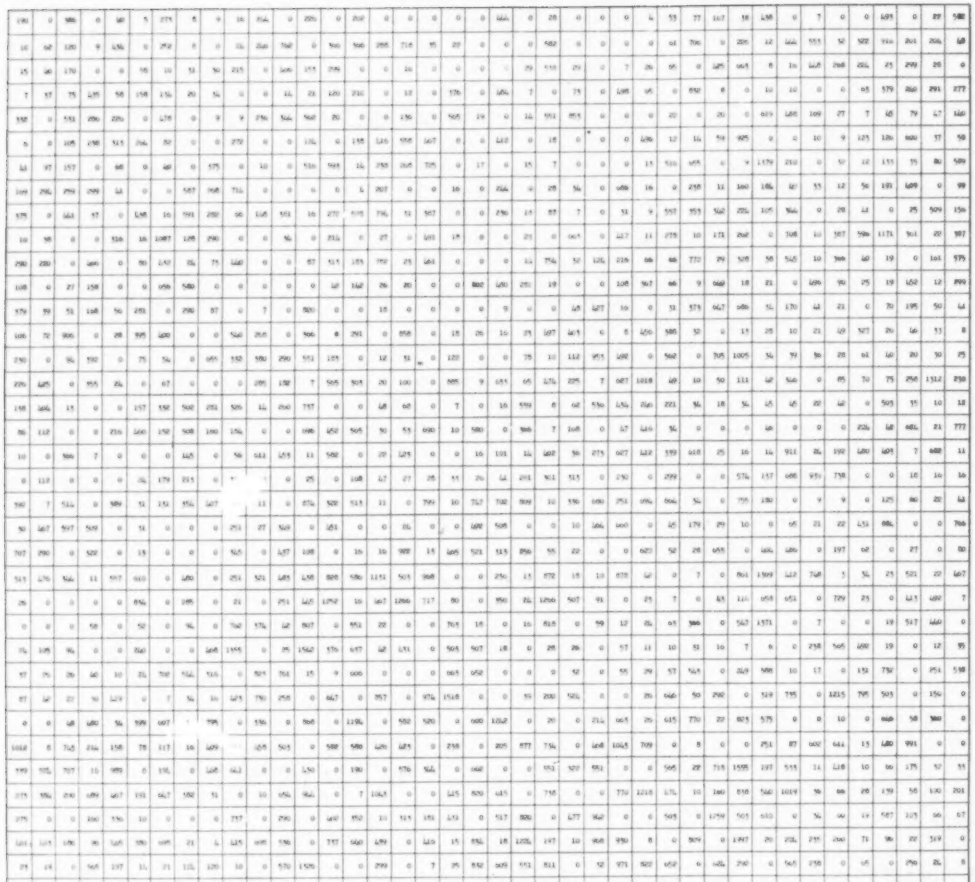

FIG. 1.—100 percent cruise of 40 acres of old growth Douglas fir timber. Each cell represents a square 1/40 acre on the ground. The number in each cell is the total timber volume (Scribner Decimal C) of the 1/40 acre unit.

plots, although coefficients of variation were calculated only for rectangular and square plots. Since a 100 percent cruise by circular plots could not be made, and since the issue was considered to be between rectangular and circular plots, it was necessary to assume that the variation among circular plots of a given area is the same as the variation among square plots of the same area.

It will also be noted that 12 kinds of plots are listed in Table 2, whereas only 10 universes were established and only 10 coefficients of variation were calculated. The two additional plots are the ¼-acre and 1/5-acre circular plots. They were included because they are so commonly used in cruising. Their coefficients of variation were taken from a curve of coefficient of variation over plot area which was established from the data of the other three circular plots.

The coefficients of variation listed in Table 2 show a tendency to decrease as the plot area increases, and for different rectangular plots of equal area there is a tendency for the longer and narrower plots to have smaller coefficients of variation.

How the Most Efficient Plot was Picked

An estimate of the total net sawtimber volume, which is obtained by measuring and otherwise observing trees on a portion of the entire tract for which the estimate is required, is exposed to two principal types of error; sampling error and technique error. Sampling er-

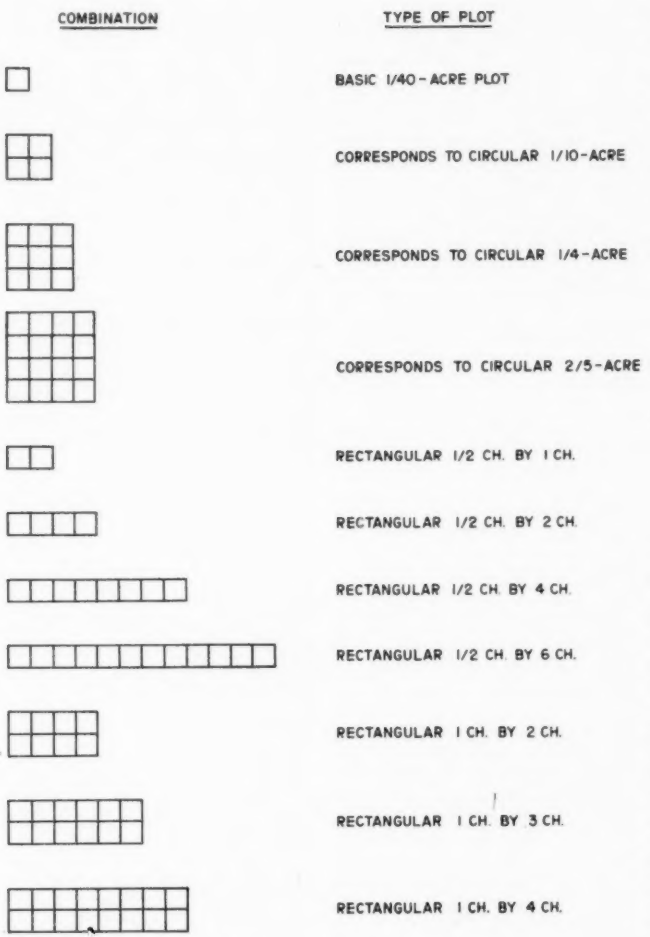
COMBINATION
TYPE OF PLOT
BASIC 1/40-ACRE PLOT
CORRESPONDS TO CIRCULAR 1/10-ACRE
CORRESPONDS TO CIRCULAR 1/4-ACRE
CORRESPONDS TO CIRCULAR 2/5-ACRE
RECTANGULAR 1/2 CH. BY 1 CH.
RECTANGULAR 1/2 CH. BY 2 CH.
RECTANGULAR 1/2 CH. BY 4 CH.
RECTANGULAR 1/2 CH. BY 6 CH.
RECTANGULAR 1 CH. BY 2 CH.
RECTANGULAR 1 CH. BY 3 CH.
RECTANGULAR 1 CH. BY 4 CH.

FIG. 2.—Basic 1/40-acre plot and various combinations.

ror is the difference between the total volume of the tract as estimated from the sample and the total volume that would have resulted if a 100-percent cruise of the tract had been made. Technique error is the difference between the total volume that would have resulted from a 100-percent cruise and the *true* total volume on the tract.

The amount of technique error depends upon the accuracy of the cruiser's measurements and observations and on the reliability of his volume tables. It is not usually possible to provide an objective estimate of the amount of technique error to which the estimate of total volume is exposed.

The amount of sampling error, on the other hand, can be estimated by using the appropriate statistical methods and by making certain minor assumptions. It varies inversely with the square root of the number of plots which have been included in the sample; directly with the square root of the proportion of the total number of possible plots *not* included in the sample; and directly with an index of the variation among the volumes recorded for the various plots of the sample. These relationships are expressed in symbols as follows:

$$E = C\sqrt{1/n}\sqrt{N-n/N}$$

Where E = Sampling error of an estimate of total volume on a given tract expressed in percent of the total volume and in terms of one standard error.

C = The coefficient of variation appropriate to a particular kind of plot.

N = Total number of possible plots of a given kind in the tract of timber for which an estimate of total volume is required.

n = Number of plots of a given kind in a sample.

Obviously if plots of one kind vary greatly among themselves, that kind of plot is likely to be inefficient. But it is not necessarily true that the kind of plot with the least amount of variation is the most efficient. One kind of plot might, for example, have the smallest coefficient of variation and yet be so difficult to take that, for a given amount of work, only a few plots could be included in a sample. It is apparent from the formula given above that the amount of sampling error will be small if the sample is large. For maximum efficiency, therefore, a plot must provide the best compromise between variation and time.

The most efficient kind of plot may be defined as *the one which will give the smallest sampling error for a given amount of work*, and in order to determine the most efficient kind of plot for this study, it was necessary to calculate a sampling error for each kind of plot.

The time study information was used to calculate, for each kind of plot, the number of systematically spaced plots which could be taken in a 4-hour cruise of a 40-acre tract of timber. These are the values of "n" listed in Table 2. Both time spent on the plot and time spent going between plots were taken into consideration in

TABLE 2.—SAMPLING ERRORS FOR 12 KINDS OF PLOTS

Kind of plot	C	n	N	E
	Percent			*Percent*
1. Rect. 1-ch. by 3-ch.	50.09	13.18	133	13.10
2. Rect. 1-ch. by 2-ch.	58.40	16.50	200	13.77
3. Circ. 1/4-acre	56.00[1]	14.21[1]	160	14.15
4. Rect. 1/2 by 6-ch.	48.95	10.83	133	14.26
5. Rect. 1/2 by 4-ch.	57.56	14.87	200	14.36
6. Circ. .225-acre	58.05	14.93	178	14.38
7. Circ. 2/5-acre	49.00	10.25	100	14.50
8. Circ. 1/5-acre	60.00[1]	15.68[1]	200	14.55
9. Rect. 1-ch. by 4-ch.	48.84	9.89	100	14.74
10. Circ. 1/10-acre	71.09	21.16	400	15.04
11. Rect. 1/2 by 2-ch.	74.58	21.62	400	15.60
12. Rect. 1/2 by 1-ch.	96.08	31.99	800	16.64

[1]Not computed directly from basic data but determined from curves of values from other plots.

C.—Population coefficient of variation in percent.

n.—Number of systematically spaced plots which can be taken in a 4-hour cruise of 40 acres.

N.—Total possible number of plots in 40 acres.

E.—Sampling error resulting from 4 hours' work.

TABLE 3.—SAMPLING ERRORS FOR 3- AND FOR 5-HOUR CRUISES OF 40 ACRES

Kind of plot	For 3-hrs. work on 40-acres	Kind of plot	For 5-hrs. work on 40-acres
	Percent		*Percent*
Rect. 1 × 3-ch.	16.31	Rect. 1 × 3-ch.	11.03
Rect. 1 × 2-ch.	17.30	Rect. 1 × 2-ch.	11.54
Rect. 1/2 × 6-ch.	17.46	Circ. 1/4-acre	11.93
Circ. 1/4-acre	17.70	Circ. .225-acre	12.10
Rect. 1/2 × 4-ch.	17.86	Rect. 1/2 × 4-ch.	12.16
Circ. 2/5-acre	17.93	Rect. 1/2 × 6-ch.	12.17
Circ. .225-acre	17.98	Circ. 1/5-acre	12.28
Rect. 1 × 4-ch.	18.17	Circ. 2/5-acre	12.29
Circ. 1/5-acre	18.26	Circ. 1/10-acre	12.53
Circ. 1/10-acre	19.05	Rect. 1 × 4-ch.	12.53
Rect. 1/2 × 2-ch.	19.77	Rect. 1/2 × 2-ch.	13.03
Rect. 1/2 × 1-ch.	21.70	Rect. 1/2 × 1-ch.	13.57

calculating "n." A 40-acre tract was specified because that is a typical cruising unit, and 4-hours were specified because that is a reasonable average time for cruising 40 acres of old-growth Douglas-fir timber.

Values for "C," "n," and "N" were substituted in the formula for sampling error given above, and 12 sampling errors, one for each kind of plot were calculated (Table 2).

The plots in Table 2 are listed in the order of their efficiency. It may be noted that three kinds of plots had lower coefficients of variation than the rectangular 1-chain by 3-chain plot which was the most efficient. In each of these three cases the advantage resulting from decreased variation was more than counterbalanced by the disadvantage arising from the fact that fewer plots were available for the sample.

Eight kinds of plots had an advantage over the rectangular 1-chain by 3-chain plot in that it was possible to include more units in the sample for a given amount of work. In these cases the advantage in terms of sample size could not compensate for the disadvantage in terms of variation.

The rectangular 1-chain by 3-chain plot provided the best compromise between variation and time.

New values of "n" and "N" were determined for a 3-hour cruise of 40-acres and also for a 5-hour cruise of 40-acres. They were substituted in the formula and new values of sampling error were calculated. In each case (Table 3) the 1-chain by 3-chain rectangular plot retained its lead, but the order of efficiency for the remaining plots was changed somewhat. This change, of course, results directly from the influence of total cruise time on the total travel time among systematically spaced plots.

The foregoing discussion on how the most efficient plot was picked requires an additional qualifying statement which is made necessary by the fact that the "n" used in the formula for calculating sampling errors for Tables 2 and 3 was determined from samples of systematically spaced plots. The formula applies only to random samples, since systematic samples have a tendency to give biased estimates of universe coefficients of variation.[4] In order to defend the superiority of the 1-chain by 3-chain rectangular plot, therefore, it is necessary to *assume* that the 12 kinds of plots tested in this study would be affected in the same degree by this tendency toward bias. This is believed to be a reasonable assumption.

The results of this study suggest that similar studies in other regions and in other forest types may show ways of stretching the cruise dollar under different circumstances. For old-growth Douglas-fir the evidence favors use of a 1-chain by 3-chain rectangular plot.

[4]Hasel, A. A. 1938. Sampling error in timber surveys. Jour. Agric. Research 57:713-736.

Root Mortality of Shortleaf and Loblolly Pine In Relation to Soils and Littleleaf Disease

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SEVERE ROOT DETERIORATION has consistently been observed during the investigations into the cause of the littleleaf disease of shortleaf pine (*Pinus echinata* Mill.) and loblolly pine (*P. taeda* L.) in the Southeast. Siggers and Doak (*9*) first recorded that the roots of littleleaf trees were consistently defective, with the finer roots of the laterals often dead. Jackson (*7*) reported in more detail on the condition of the root systems of diseased and healthy trees. He found that 71 percent of the roots of littleleaf-diseased trees had dieback, against only 17 percent of the roots of healthy trees.

An important characteristic of the littleleaf disease is that affected trees do not assimilate some nutrient elements, in particular nitrogen, in quantities considered normal for healthy trees. Excessive root mortality, with *Phytophthora cinnamomi* Rands as a contributory cause (*2*) may account for this reduced nutrient uptake and is likely to be closely related to the cause of littleleaf. *P. cinnamomi* is known to attack the small feeding roots of pine and this fact increases the significance of this study.

The object of this study was to determine the size, condition, and distribution of shortleaf and loblolly pine roots in relation to soil properties in the top 12 inches of five soil series for five age and condition classes of trees. This study was carried out on the Calhoun Experimental Forest near Union, S. C.

Experimental Procedure

The age and condition classes consisted of young healthy shortleaf and young healthy loblolly trees, 14 to 18 years old, and older healthy loblolly, older healthy shortleaf, and older littleleaf diseased shortleaf trees, 34 to 42 years old.

Trees representative of the stands in which root counts were to be made were selected. A soil pit, approximately 18 inches deep, 24 inches long, and 18 inches wide, was dug 10 feet from the base of the tree and at a right angle to a radius extending from the tree. The side of the pit nearest the tree was shaped vertically, and brushed clean of loose soil. A wooden frame, 12 inches square, inside dimensions, with nylon cord stretched taut in both directions to form a 1-square-foot grid, was placed against the vertical wall of the soil pit, with the top of the grid flush with the surface of the ground. The side of the pit was then carefully probed for roots and the size, condition, and position of each root was plotted on a grid record sheet. When it was apparent that roots from other trees fell within the transect limits, they were excluded from the tabulation.

Undisturbed soil cores and loose soil samples were taken by successive 2-inch depths from the areas in which root counts were made. Several physical properties of these samples were measured in duplicate, such as volume weight, porosity, percolation rates of water, particle size distribution, moisture equivalent, and imbibitional water values.

Volume weight was determined on undisturbed 250-cubic centimeter volume samples. Porosity was determined by the use of a tension table similar to that described by Lèamer and Shaw (*8*). Percolation rates, expressed as inches of water per hour, were obtained on undisturbed saturated core samples under a head of 1 centimeter of water. Particle size distribution data were obtained by the Bouyoucos hydrometer method. Moisture equivalents were determined essentially in accordance with the method outlined by Briggs and McLane (*1*). Imbibitional water represents the difference between the moisture equivalent and the xylene equivalent.

Description of Soils

The soils in which the root counts were made are briefly described below.

Cecil series.—This soil series is formed from weathered gneisses, gneissoid schists, mica schists, and granites. It is well drained and the topography ranges from nearly level to hilly.

Davidson series.—The soils of this series are formed from the weathered products of dark-colored basic rocks. The series is well drained and occupies undulating to steep topography.

Cataula series.—This series occurs in close association with the Vance and Cecil soils and is developed from similar materials, but is influenced locally by slightly basic rocks. The upper "B" horizon is heavier and more dense than that of the Cecil series. Surface drainage is good, but internal drainage is somewhat slow.

Vance series.—The soils of this series occur in association with the Appling and Cecil soils, and are developed from similar materials. The subsoil is heavy, tough, and slightly plastic. Surface drainage is good, but internal drainage is slow.

Mecklenburg series.—This series is developed from dark-colored basic rocks and occurs in close association with the Davidson and Iredell soils. These soils occupy undulating to rolling areas. Surface drainage is slow because of the heavy character of the subsoil.

Results and Discussion

As a preliminary study, 15 healthy and 15 littleleaf shortleaf pine trees of the older group were selected for root counts on the Cataula soils series. Roots were counted in two transects for each tree, with one transect located on the opposite side of the tree from the other. The total number of roots varied between the individual transects of a pair, yet when such comparisons were made for all 15 trees within a group, these differences proved not to be significant. It was concluded from this prelim-

[1]The author expresses his appreciation to M. D. Hoover for helpful suggestions during the course of this study.

inary study that a 1-square-foot transect per tree would be an adequate area for this work.

A total of 310 square-foot transect counts was made in sampling the five age and condition classes of trees on the five soils. For each age and condition class, 12 to 15 trees were sampled on each soil. Tree and root data by soils and by age and condition classes are shown in Table 1. The mean age, height, and d.b.h., respectively, for the young healthy loblolly class is 17 years, 32 feet, and 8.2 inches; for the young healthy shortleaf class, 15 years, 24 feet, and 4.7 inches; for the older healthy loblolly, 37 years, 52 feet, and 15.1 inches; for the older healthy shortleaf, 36 years, 46 feet, and 11.5 inches; and for the older littleleaf shortleaf class, 37 years, 42 feet, and 10.9 inches.

TABLE 1.—TREE AND ROOT DATA BY SOILS, AGE, AND CONDITION CLASSES[1]

Soil series	Average age	Average d.b.h.	Total roots counted	Average dead roots
	Years	*Inches*	*Number*	*Percent*
	Young healthy loblolly			
Cecil	16	9.8	226	2.7
Davidson	15	7.5	167	4.2
Cataula	18	9.3	200	2.5
Vance	17	7.1	144	1.4
Mecklenburg	18	7.1	244	6.6
All	17	8.2	981	3.7
	Young healthy shortleaf			
Cecil	15	4.3	205	2.5
Davidson	15	5.1	190	1.1
Cataula	14	4.0	192	4.2
Vance	14	4.6	167	2.4
Mecklenburg	15	4.7	173	4.6
All	15	4.7	927	2.9
	Older healthy loblolly			
Cecil	34	16.1	312	8.0
Davidson	36	16.0	245	6.9
Cataula	42	14.4	239	4.6
Vance	38	15.4	318	6.6
Mecklenburg	35	13.5	333	5.1
All	37	15.1	1,446	6.3
	Older healthy shortleaf			
Cecil	36	11.4	525	16.4
Davidson	37	12.4	410	13.9
Cataula	34	11.0	296	22.0
Vance	38	11.1	438	18.7
Mecklenburg	35	11.5	597	19.9
All	36	11.5	2,266	18.0
	Older littleleaf shortleaf			
Cecil	36	11.0	481	35.1
Davidson	39	10.7	381	32.3
Cataula	37	11.5	410	35.4
Vance	37	10.6	413	32.7
Mecklenburg	34	10.6	467	36.0
All	37	10.9	2,152	34.4

[1]For each age and condition class, 12 to 15 trees were sampled on each soil.

There is only 0.8 percent difference between the percentages of dead roots on healthy young shortleaf and loblolly pine. Healthy older loblolly had an average of 6.3 percent dead roots, or almost twice as many as young loblolly trees. The older healthy shortleaf class had 18 percent roots dead, or almost 3 times as many as loblolly of a comparable age. Older littleleaf shortleaf trees had an average of 34.4 percent roots dead, or almost twice the percentage of dead roots found on older healthy shortleaf. These comparisons by age and condition classes suggest that there may be a critical percentage of dead roots lying somewhere between 18 and 34 percent, and when a tree's root system deteriorates beyond such a critical percentage, nutrient assimilation may be decreased to such an extent that the tree declines and littleleaf symptoms appear. The data in Table 1 also suggest that the low incidence of littleleaf on loblolly observed throughout the littleleaf range may be correlated with lower root mortality.

An increase in dead roots on shortleaf from 3 percent at 15 years to 18 percent at 35 years might explain why the onset of littleleaf is noted only near or above 20 years of age. Hawboldt and Skolko (*6*), in discussing root mortality in relation to yellow birch dieback, state "A direct comparison between the data of Hall, Spaulding and MacAloney, and that presented in Table 3 is not justified because of probable differences in methods but it is strongly suggestive that 30 percent rootlet mortality in an apparently thrifty tree may actually represent the first stages of dieback since Hall found 12 percent or less in the thrifty trees he examined and Spaulding and MacAloney found only 3.8 percent root tip mortality in a healthy tree. The need of further information on this point is clearly indicated." The similarity between these findings and those reported here on pine substantiates the probability of a critical percentage of root mortality beyond which a tree cannot remain thrifty.

TABLE 2.—OCCURRENCE AND MEAN DIAMETERS OF OLDER SHORTLEAF AND LOBLOLLY PINE ROOTS AT INDICATED DEPTHS

Depth below surface	Older healthy loblolly pine roots		Older healthy shortleaf pine roots	
	Total	Mean diameter	Total	Mean diameter
Inches	*Percent*	*Inches*	*Percent*	*Inches*
0- 1	21.1	.14	27.7	.13
1- 2	12.4	.22	14.7	.14
2- 3	14.0	.19	11.9	.17
3- 4	9.7	.22	9.0	.20
4- 5	8.6	.19	7.1	.26
5- 6	6.8	.20	6.6	.19
6- 8	13.3	.24	9.4	.20
8-10	7.6	.25	8.3	.19
10-12	6.4	.17	5.3	.17

For the five classes of trees, the average number of roots per square-foot transect is as follows: young loblolly, 15; older healthy loblolly, 24; young shortleaf, 16; older healthy shortleaf, 38; and older littleleaf shortleaf, 36. Shortleaf pine, both the young and the older, produce a larger average number of roots than does loblolly. The data in Table 2 show that in the top 2 inches of soil, shortleaf pine produces a larger percentage of the total number of roots than does loblolly, and not until the 3-inch depth is reached does the percentage of loblolly roots exceed that of shortleaf. These distribution data reveal that loblolly roots are more deeply distributed throughout the soil than are shortleaf pine roots.

Examination of the mean diameter data of shortleaf and loblolly pine roots in Table 2 shows that there is a definite increase in mean diameter with increasing depth below the surface for the first 10 inches. Older shortleaf pine roots attain their greatest mean diameter in the 4- to 5-inch depth, while loblolly roots reach their greatest mean diameter in the 8- to 10-inch depth. The mean diameters of loblolly roots equal or exceed those of shortleaf at all depths examined except at the 4- to 5-inch zone.

In studying the cross-sectional root areas, roots were grouped into four diameter classes as follows: roots up to ¼-inch diameters; from ¼-inch to ½-inch in diameter; from ½-inch to 1-inch diameter; and 1-inch and larger. The midpoint of each size class was taken as the average diameter for all roots in the first three classes. For

TABLE 3.—TABULATION OF ROOTS BY SIZE CLASSES AND CROSS-SECTIONAL AREA FOR THE AGE AND CONDITION CLASSES OF SHORTLEAF AND LOBLOLLY PINE

Soils	Size classes								Cross-sectional root area			
	Less than ¼-inch diameter		¼-inch to ½-inch diameter		½-inch to 1-inch diameter		1 inch and larger in diameter		Roots less than ¼-inch in diameter		All roots	
	Total	Dead	Total	Dead	Total	Dead	Total	Dead				
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Square inches*	*Percent dead*	*Square inches*	*Percent dead*
YOUNG HEALTHY LOBLOLLY												
Cecil	199	3	17	0	6	0	3	0	2.5	2.9	16.4	0.4
Davidson	151	5	14	0	2	0	0	0	1.9	4.8	4.3	2.1
Cataula	183	3	10	0	6	0	1	0	2.3	2.7	9.2	0.7
Vance	130	2	10	0	4	0	0	0	1.6	1.3	4.5	0.5
Mecklenburg	217	7	15	0	11	0	1	0	2.7	6.7	12.3	1.6
YOUNG HEALTHY SHORTLEAF												
Cecil	184	3	16	0	4	0	0	0	2.3	2.7	5.8	1.0
Davidson	176	1	13	0	1	0	0	0	2.2	0.9	4.0	0.5
Cataula	177	5	11	0	4	0	0	0	2.2	4.6	5.2	1.9
Vance	151	2	11	9	5	0	0	0	1.9	2.2	5.3	2.8
Mecklenburg	164	5	7	0	1	0	1	0	2.0	5.0	6.4	1.6
OLDER HEALTHY LOBLOLLY												
Cecil	282	9	10	0	14	0	6	0	3.5	8.9	29.6	1.1
Davidson	214	8	16	0	13	0	2	0	2.6	8.0	16.4	1.3
Cataula	210	4	18	11	7	0	4	0	2.6	4.3	20.2	1.1
Vance	280	8	24	0	7	0	6	0	3.4	7.6	28.0	0.9
Mecklenburg	288	6	25	0	15	0	5	0	3.4	6.1	28.6	0.7
OLDER HEALTHY SHORTLEAF												
Cecil	489	17	23	4	6	0	7	0	6.0	17.1	33.2	3.5
Davidson	374	14	26	12	6	0	4	0	4.6	14.3	22.7	4.4
Cataula	265	24	18	11	8	13	4	0	3.3	23.3	21.3	6.7
Vance	392	19	25	20	16	19	5	20	4.8	18.7	30.4	19.5
Mecklenburg	563	21	21	5	8	0	5	20	6.9	20.8	28.5	16.5
OLDER LITTLELEAF SHORTLEAF												
Cecil	458	36	14	29	6	17	3	0	5.6	35.9	19.2	15.0
Davidson	348	34	21	24	11	9	1	0	4.3	33.6	14.6	16.7
Cataula	357	37	26	23	20	25	7	14	4.4	36.9	38.1	20.1
Vance	381	34	21	14	10	20	1	0	4.7	34.1	14.6	19.3
Mecklenburg	416	38	29	24	8	25	8	13	5.1	37.9	37.0	18.2

the last class, 2 inches was estimated to be the average diameter. These average diameters were used in calculating cross-sectional root areas. Cross-sectional root areas and a tabulation of total roots by size classes for the several age and condition classes of trees are presented in Table 3. The cross-sectional root areas of the young loblolly trees on all soils except Vance exceed those of shortleaf of the same age class, and, except on the same soil, a greater percentage of the total root area of loblolly trees occurred in the subsoil than was found with shortleaf. This shows the greater ability of loblolly roots to penetrate deeper into heavy subsoils. Although there is little variation between total cross-sectional areas for roots of older healthy loblolly and shortleaf, fewer roots were found on loblolly, indicating that generally loblolly roots are larger than shortleaf roots of a comparable age.

Most of the dead roots occurring on healthy young and older loblolly were of the smallest size class, less than ¼-inch in diameter. On young healthy shortleaf, mortality was highest in roots less than ¼-inch in diameter, and on older healthy shortleaf, root mortality was highest in roots less than ½-inch in diameter. On older littleleaf shortleaf trees, mortality occurred to a great extent in all size classes of roots.

Cross-sectional root area data of roots less than ¼-inch in diameter and the cross-sectional root area of all roots are contained in Table 3. The mean percentages of dead root area for the smallest size class of roots by age and condition classes as calculated from Table 3 are as follow: young healthy loblolly, 3.9 percent; young healthy shortleaf, 2.2 percent; older healthy loblolly, 7.1 percent; older healthy shortleaf, 15.1 percent; and older littleleaf shortleaf, 35.7 percent. These comparisons show close agreement with the mean percentages of dead roots by age and condition classes in Table 1, and it appears that either the percentage of total roots dead or the percentage of dead root cross-sectional area of roots less than ¼-inch in diameter would adequately serve to indicate the condition of a tree's root system.

An attempt was made to correlate the various soil properties that were measured with the percentages of dead roots, sizes of roots, and root distribution. Table 4 contains the statistical analyses of the relation between the total number of roots by 2-inch depths on all soils based on 12 transects for each soil and the various physical properties under consideration. Only

TABLE 4.—REGRESSIONS AND SIGNIFICANCE OF THE NUMBER OF ROOTS IN RELATION TO SOIL PROPERTIES BY SPECIES

Species	Soil property	Regression equation	Level of significance[1]
			Percent
Shortleaf	Imbibitional water	$Y = 177.94 - 17.39\ X$	1
Loblolly		$Y = 100.34 - 8.50\ X$	5
Shortleaf	Percolation rate	$Y = 45.26 + 33.94\ X$	1
Loblolly		$Y = 34.33 + 18.47\ X$	1
Shortleaf	Pore space drained by 60 cm. tension	$Y = 7.94 + 8.14\ X$	1
Loblolly		$Y = 10.82 + 4.84\ X$	1
Shortleaf	Moisture equivalent	$Y = 83.01 - 0.62\ X$	Not significant
Loblolly		$Y = 54.89 - 0.34\ X$	
Shortleaf	Percent clay <.022 mm.	$Y = 187.60 - 4.31\ X$	1
Loblolly		$Y = 108.97 - 2.24\ X$	1
Shortleaf	Volume weight	$Y = 503.60 - 284.80\ X$	1
Loblolly		$Y = 245.97 - 130.13\ X$	1

[1]Determined by "t" test.

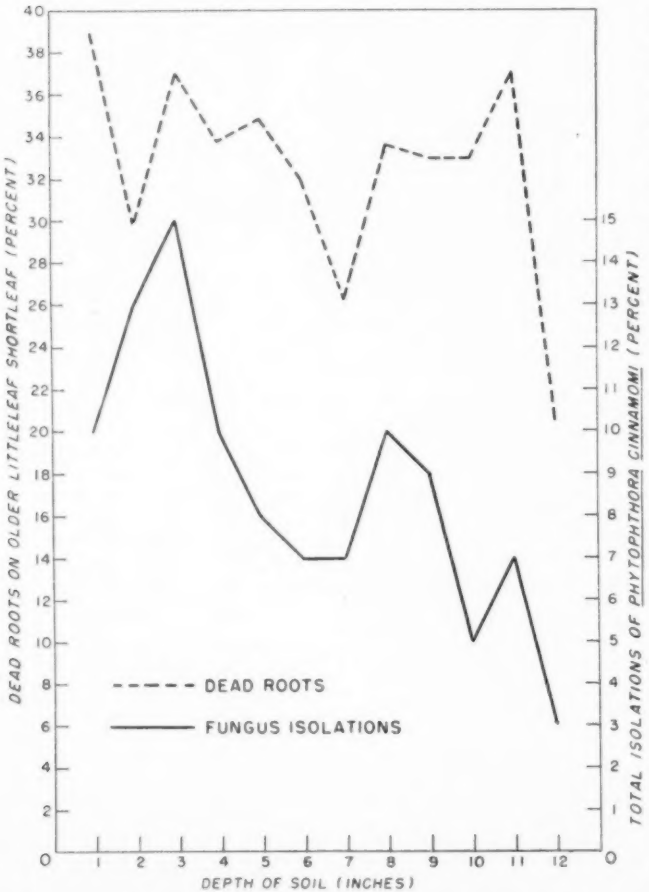
DEAD ROOTS ON OLDER LITTLELEAF SHORTLEAF (PERCENT)
TOTAL ISOLATIONS OF PHYTOPHTHORA CINNAMOMI (PERCENT)
DEPTH OF SOIL (INCHES)
DEAD ROOTS
FUNGUS ISOLATIONS

FIG. 1.—Comparison of *Phytophthora cinnamomi* isolations with the percentage of dead roots on older littleleaf shortleaf. Fungus isolation data from Campbell (*3*).

the older healthy loblolly and older healthy shortleaf were used in these correlations.

All the physical properties measured, except the moisture equivalent, are significantly related to the total number of roots by 2-inch depths, to 12 inches, on both shortleaf and loblolly. Veihmeyer and Hendrickson (*10*) have shown that in dealing with subsoils dense enough to prevent the entrance of roots, the moisture equivalent is essentially meaningless. The same workers have also shown that there was no penetration of sunflower roots into clay soils when the soil density reached values of 1.6 or 1.7. In this study, the majority of pine roots occur where the volume weight is less than 1.6, and this agrees well with the above report. The two factors having the greatest effect on root distribution appear to be noncapillary porosity and volume weight. These factors operate conjunctively; that is, the greater the porosity the lower the volume weight and vice versa, and no attempt is made to ascribe the relative importance of each factor. No correlation was found between the physical properties that were measured and root mortality expressed either as the percentage of dead roots or dead root area. Although root mortality percentages in Table 1 are much the same for the different soils within a condition class, such as older littleleaf shortleaf, this in no way implies a lack of relation of soil properties to root mortality. Trees in each condition class, such as advanced littleleaf, were deliberately chosen and such trees would have similar root deterioration status regardless of what soil they are growing on, but, as previously shown (*5*) many fewer such trees occur on the better drained soils than on the poorer.

Most of the information on the onset, symptoms, and course of littleleaf suggest the action of a root pathogen influenced by soil conditions. Campbell (*3*) studied the vertical distribution of the abundance of *Phytophthora cinnamomi*, a pathogenic fungus that

is found associated with dead roots of littleleaf trees, at 1-inch depths from 1 to 12 inches in the soil under 28 littleleaf trees. The fungus was found most abundant at the 2- and 3-inch depths, after which it declined to less than half as abundant at the 6- and 7-inch depths. The fungus became somewhat more abundant at the 8- and 9-inch depths, falling off rapidly to 12 inches.

Phytophthora cinnamomi occurs most abundantly in the soil under littleleaf trees at the depth at which most of the fine feeding roots develop. Figure 1, a comparison of *P. cinnamomi* isolations with the percentages of dead roots, shows Campbell's isolation data and the percent of dead roots on older littleleaf shortleaf as determined in this study. There is generally close agreement, except for the first inch, between the isolation of the fungus and the percentage of dead roots. The lack of agreement at the 1-inch depth is explained by the fact that the top 1 inch of soil is subject to frequent and intense drying during the hot summer months. This condition is unfavorable for fungus growth, yet it could result in high root mortality because of the high temperatures and low soil moisture. The agreement between the isolation of *P. cinnamomi* by Campbell and the percentages of dead roots as found by this work supports the view that some agent such as *P. cinnamomi* may be responsible for the excessively high root mortality of littleleaf trees (*2*). Considerable additional evidence on the relation of *P. cinnamomi* to littleleaf has been obtained by Campbell (*4*) in his studies of fungi.

Summary

The sizes, condition, and distribution of shortleaf and loblolly pine roots in the top 12 inches of five soils in the Piedmont Plateau were studied by the use of square-foot transect counts. The percentages of dead roots by age and condition classes of trees are as follows: young healthy loblolly 3.7, young healthy shortleaf 2.9, older healthy loblolly 6.3, older healthy shortleaf 18.0, and older littleleaf shortleaf 34.4.

There appears to be a critical percentage of dead roots, somewhere between 18 and 34 percent, beyond which a tree cannot continue normal growth and begins to decline. Shortleaf feeding roots are most abundant in the upper few inches of soil, while loblolly roots are fewer in number and larger in size, are more deeply distributed, and show greater ability to penetrate heavy soils. Mean diameters for shortleaf and loblolly roots at various depths are given.

The data derived from this study indicate that mortality of roots less than ¼-inch in diameter is of great importance in influencing the decline of shortleaf pine trees. Porosity and volume weight of soils appear to exert the greatest influence on root distribution, with the most roots occurring at depths having the highest porosities and the lowest volume weights, but no correlation was found between root mortality and several soil properties studied. It appears from the associated work of Campbell (*2*) that a pathogenic root fungus *Phytophthora cinnamomi* may be responsible for the high root mortality of the small roots of littleleaf trees.

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Attractions of Forestry as a Career

The attractions of forestry as a career, and the esteem in which it is held, rather than financial remuneration, seem to have been the chief force attracting men into the profession. Work with nature in the out-of-doors, far from the man-made roar and competition of the cities, has offered to many men an incentive over-balancing a scale of pay somewhat below that for equally trained civil servants with comparable professional status. Though it is to be hoped from the standpoint of public policy that more generous pay scales can be provided for qualified foresters, it must be noted that even this disadvantage of the forestry profession has not prevented the recruitment of a singularly competent level of personnel, nor the development of a professional service of extraordinarily high devotion and enthusiasm.

From *American Forest Policy* by
LUTHER H. GULICK, 1951.

Any Forester Can Use Aerial Photographs

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This article is for foresters who have had little or no experience in using aerial photographs in the field. The author takes the reader on an imaginary field trip and shows him how easy it is to use aerial photographs for finding his way around in the woods and for locating randomly selected sample plots in unfamiliar territory. Along the way, he talks about some of the fundamentals of aerial photography.

YES, ANY FORESTER can use aerial photographs. Many of you do not use them because you have never had an opportunity to become familiar with them. As a result, you perhaps do not realize just how valuable they could be to you.

Unfortunately, most of the published material dealing with aerial photography in forestry has been concerned with photo interpretation and other technical problems. Too little has been published about the subject nearest the heart of the average forester: How can aerial photos help me in my day-to-day work in the woods?

One of the most difficult jobs a forester has to do in an unfamiliar area is to orient himself so that he can move swiftly and surely through the woods. Although the travel is usually incidental to the work he is doing, it often consumes a large part of his time and effort. In fact it might be said that fully half of a timber cruiser's job is keeping track of where he is, where he is going, and where he has been. This is especially true when plots are scattered at random throughout a large area.

Before the advent of aerial photography, to locate a point on the ground represented by a pin-prick on a map would have been difficult—even with a good map. Without a good map it would have been impossible. Today, with almost complete photographic coverage of all major forest areas, this "impossible" task is an everyday occurrence. Sample plots are located quickly and surely, usually to within a few links of the exact point marked on the photo.

So let us consider aerial photographs solely as an aid in getting around the woods.

First, let's assume a field problem. We are taking part in an extensive forest survey, such as the various experiment stations of the U. S. Forest Service are now making. We have established our field headquarters at Lyon Mountain, N. Y. Our job is to locate and measure sample plots in that vicinity. Our immediate problem is to find our way to the plot represented by point *P* on the aerial photo (Fig. 1).

Two questions confront us: (1) What is the quickest and easiest way to get there? (2) How do we know where we are when we do get there?

If we didn't have photographic coverage of the area—only a topographic map—we would really have a problem. Instead of completing the whole job in less than half a day, we would spend hours, maybe days, running triangulation lines into the plot from reference points established on the map. One of the biggest advantages of photos is that we can choose our reference points from many objects or points that we can identify both on the photo and on the ground.

General Background[1]

Most of the aerial photographs you will use will have been taken in north-south strips, with a single camera pointing straight down. (There are multiple cameras that take oblique photos but we need not be concerned with those here.) The time and approximate scale are recorded on the first and last photos of each flight line. In addition, the date the photo was taken, the film-roll number, and the photo number are recorded on each photo. There is about 60 percent north-south overlap on adjacent photos so that the northern half of each photo covers roughly the same area as the southern half of its northern neighbor. This makes stereoscopic, or third dimensional, vision possible. Most photos are 9 inches square or 7 by 9 inches. On a scale of 1:20,000 about 3 inches equal 1 mile. This means that you need carry only two or three photos with you on every jaunt into the woods.

Although you can use one print as a photographic map, the many advantages of stereoscopic coverage far outweigh the slight inconvenience of carrying a pocket stereoscope and an extra photo or two. With some practice, you can view two photos stereoscopically with your naked eyes. This is a useful trick in emergencies. But the ease of use and slight magnification offered by the stereoscope make it well worth while for you to have one of these handy, inexpensive instruments.

Stereoscopic vision is obtained by placing two photos on a flat surface with the north side of each to your right (or left if you prefer). Locate the point or area to be viewed on one photo. Then move the other photo so that a line between the same point on both photos is roughly parallel to a line between the centers of the two photos. The corresponding points should be about 2½ inches apart. Do not look through the stereoscope until the photos are properly oriented. Then adjust the position of the photos to your own eyes. After some practice the procedure becomes almost automatic and you can get stereoscopic vision in the field by holding the two photos in one hand and the instrument in the other.

Photo Scale

At the outset it might be well to emphasize that you do not have to be an expert in photogrammetry to use aerial photos in forestry. You need mathematics only for computing the scale, if distances are to be measured on the photos.

When you are using only two or

[1]Information regarding the availability of photo coverage for any specific area can usually be obtained from the U. S. Geological Survey, Washington 25, D. C.

three photos on fairly level land, and you know the actual ground distance between two points identifiable on the photos, photo distance is directly proportional to ground distance. However, in mountainous terrain, or when photographic coverage for a large area is to be used, the method of computing scale recently described by Rogers[2] is recommended. In about an hour you can compute the scale at sea level of an entire project, such as a county, forest, or watershed. Moreover, you can easily adjust the scale of individual photos for differences in elevation.

The average scale at sea level for Clinton County (where our sample plot is) was found to be 1:22,900. Since we expect to chain some distance into the plot, we must first adjust the scale at sea level to the scale of the plot elevation. From the U. S. Geological Survey map we find that the elevation of our plot is 1,400 feet. Rogers' chart shows us that for a 6-inch lens at this elevation, 2,800 should be subtracted from the scale at sea level. This gives us a scale of 1:20,100 at the plot. The final step is to determine a factor for converting photo distance into chains. To do this we divide the representative fraction (20,100) by the product of the number of inches in a chain and the unit of measurement to be used on the photo (we will use fiftieths of an inch):

$$\frac{20{,}100}{792 \times 50} = 0.508 \text{ chains per 1/50-inch.}$$

In moutainous country the computation is made on the basis of the average elevation between the plot and the reference point rather than the plot elevation itself. Although this gives us a more accurate factor, it necessitates making the computation in the field after the reference point has definitely been established. In comparatively level areas such as ours, however, this method would make little or no difference in the factor.

Filing and Storing Photos

First, how many photos will we need for this job, and how will we find the ones we want? Photographic coverage for the whole state is at hand. These photos occupy several standard file drawers; so you can see we need a filing method that permits us to find what we want quickly and easily. Since the photos were taken in strips, by counties, this would seem to be the logical way to file them. All the photos having the same strip or roll number are arranged in numerical order, and are placed in a separate folder. The county, roll number, and range of photo numbers are recorded on the folder. Then all the folders are kept in file drawers, according to roll numbers.

A set of photo index sheets is provided with every photo project. These sheets are greatly reduced composite photos of all the prints in a project, arranged in their respective positions; in short, small-scale photographic maps. Using these index sheets as a guide, we plot the center point of each photo on the U. S. Geological Survey topographic maps of the county. Beside each indicated point on the maps we record the corresponding roll and photo number. Then, to locate the photo for a specific area, we merely find on the map the place in which we are interested, read the nearest roll and print number, look up this number in the files, and pull out the photo. This may be done in a matter of seconds.

The number of photos we will need to take along depends on how near the plot we are sure we can get by means of a map. If the plot is within a mile or so of a main highway, the pair of photos giving stereoscopic vision of the plot should be enough. But if our point is far from any road clearly shown on the map, we need enough photos to guide us into the plot from the last known point on the map. Usually, no more than three or four photos are needed to locate any one plot; but it is better to take too many than too few.

We are now about ready to leave for the field. But first let's make a final check on our proposed route, make sure we are taking all the photos we need, and double check that we have stereoscopic coverage of the plot. If the plot is on the southern half of a photo, we want that photo and the one south of it. It is too easy to pick the adjoining one to the north and not discover our error until we are ready to begin running the final compass line.

Navigating to the Jumping-off Place

We can now get in the car and head for the woods. The man sitting next to the driver will "navigate." He directs us northwest out of Lyon Mountain on Route 374. After about 4 miles, Upper Chateaugay Lake appears on our left. As we near the lake we come to the small town of Merrill. The lake and the distinctive road pattern here make it easy to locate this point on the left-hand photo. So our navigator lays his map aside; he will guide us the rest of the way from the photo.

At Merrill (Point *M*) he tells the driver to take the right fork. This road appears narrower on the photo than the highway we just left, but since it is straight and the same shade as the main road, it is probably paved. Our navigator mentions this as well as the approximate angle of the turn. Such advance information enables the driver to plan his actions well ahead of time. This is especially helpful in rugged country where the roads have many switchbacks and hidden turns. On narrow roads, the best place to park or turn around may often be selected from the photo. Unfortunately, the details of road surfaces are not always clearly distinguishable on the photos. The type and quality of the road surface, however, are often indicated by the road's width and course. Wide, straight roads with well-engineered curves are paved highways or, at worst, all-weather gravel roads. As the width decreases and the route follows the topography more closely, road surfaces become poorer and more hazardous to travel.

As we continue northward along the secondary road, our navigator

[2]Rogers, Earl J. A short cut for scaling aerial photos. Jour. Forestry 47: 819-822. 1949.

notes on the photo that a power line crosses the road about a quarter of a mile from the fork. He watches for the wires overhead and for the wide, straight swath cut through the woods (Point *L*). In remote areas where no other landmarks are visible, the right-of-way of an electric, gas, or oil line serves as an excellent bearing line as well as a means of moving across country on foot. As the car passes under the wires, our navigator checks the position and warns the driver that about half a mile ahead the road turns abruptly to the left and that we want to stop at the farmhouse at the corner on the right side of the road (Point *F*).

All the while he has been directing our progress, our navigator has been looking for a suitable place to take a bearing line. To establish such a line you take a compass reading on the ground along a line that is easily defined on the photo. Straight stretches of road, power lines, and fence lines are the obvious places to get bearings. Lacking these, you may use a line

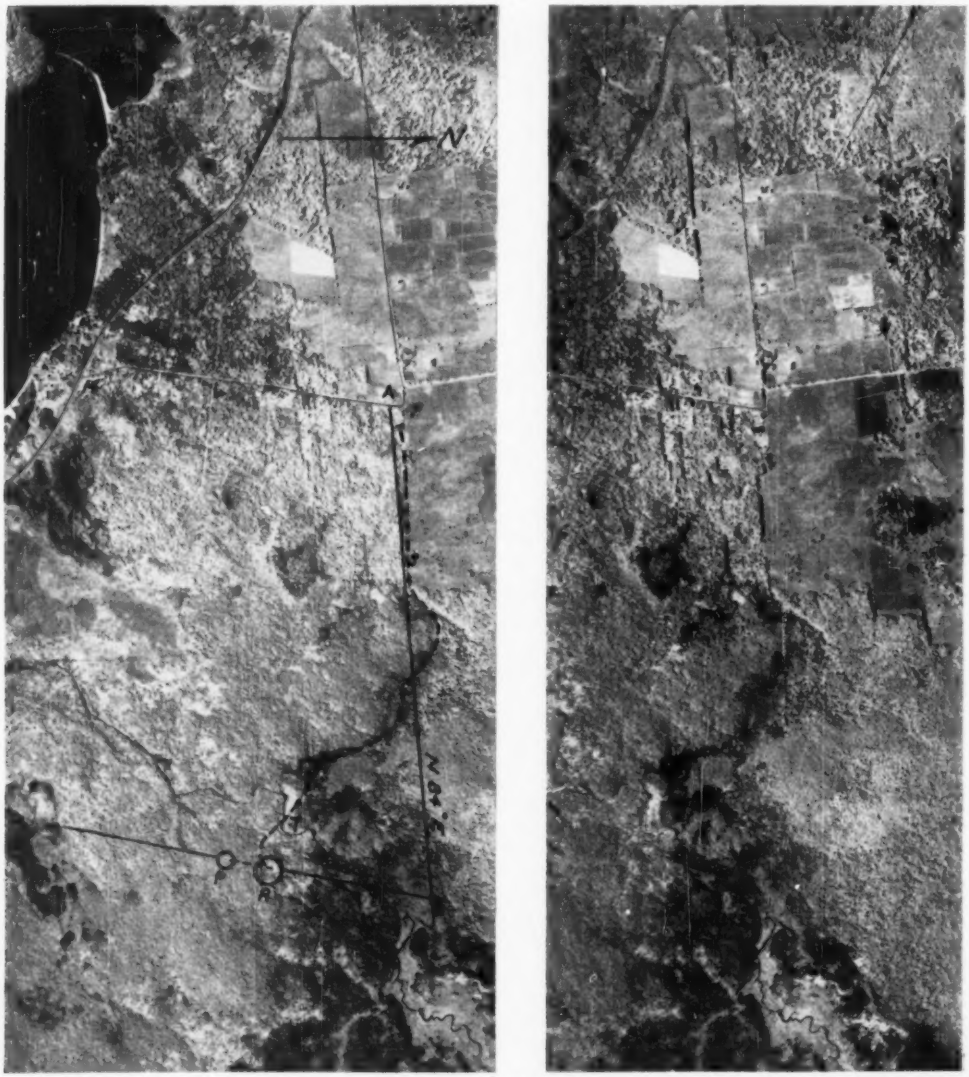

FIG. 1.—The aerial photos used in this problem. *M* marks the town of Merrill, *L* a power or telephone line, *F* a farmhouse, *S* an intermittent steam, *AB* the bearing line, *E* the reference point, *P* the sample plot. The broken line shows the route to the sample plot. Photos were taken August 26, 1948; scale is 1:20,100 at plot.

between two buildings, trees, or other prominent objects. The longer the line, the more accurate the reading. From this base line you can determine the bearing of the compass line into the plot. Most times it is impossible precisely to locate a point in the middle of the woods directly from the photo. So we usually have to run a compass line into the plot from some identifiable reference point.

Our man has chosen the fence line between the woods and the pasture a few chains east of the farmhouse at *F*. He could have taken the bearing along the road, but an extension of the fence line will come closer to the plot.

Getting a Bearing

We will leave the car at the farm opposite the turn in the road and proceed on foot. A short distance behind the barn is a small grove of trees, and beyond these is a large pasture. At the edge of the woods we take a compass reading along the line between the woods and the pasture. The bearing is N 84° E. An extension of this line is drawn across the photo and the bearing recorded beside it (Line *AB*). A soft lead pencil or a grease pencil is best for this.

Our problem now is to get as close as possible to the plot before we begin to run a line. Our course is roughly represented by the broken line on the photo. Along the way we pass a break in the woods on the right, an intermittent stream (Point *S*), and some trees scattered near the end of the pasture. The fieldman can keep track of himself at all times by identifying such features as these and noting their relative positions on the photos. In this way he can tell almost immediately if he deviates from his course.

At the end of the pasture we drop down over a bank into a long narrow arm of cleared land that extends into the woods. To the right is a narrow band of young softwoods extending down across the flat and into the ravine.

Are Winter or Summer Photos Better?

The spruce stand near the head of the hollow appears to be of sapling size and is probably rather difficult to walk through. So we will walk parallel to this strip of softwoods but in the adjacent hardwood stand. Softwood trees may be readily distinguished on photos because of the great contrast in shading. Softwoods photograph black; hardwoods show up as various shades of gray. Any further breakdown of species is very difficult on pictures taken in August (as ours are). At this time the foliage of all hardwood species is more uniform in color than at any other time during the year.

This brings up a controversial question: What is the best season for photographing forest land? The point of disagreement is whether the forester can glean more information from photos taken in the summer and fall when the leaves are on the trees, or during the winter and early spring when the trees are bare. Those who prefer winter photos contend that, although hardwood trees are less plainly visible without their leaves, the fuzzy outline may still be seen as well as the shadows cast by the boles. Moreover, leafless vegetation allows such otherwise indistinct features as woods trails, small streams and ravines, rock outcroppings, and erosion characteristics to be seen clearly. However, most forester-photointerpreters favor photos taken when the vegetation is in full foliage, preferably when the leaves are turning in the fall. This type of photography affords the maximum contrast in shading, so forest types and tree species can be identified much more easily. Although the blanket of vegetation tends to smooth out the sharp physiographic irregularities, many of these can be identified by inference.

We are fortunate in having photos that were taken only two years ago. The nearer to the time of use a photo is taken, the less chance there is for changes on the land in the interim. Sometimes the only photos available for a particular area are more than 10 years old. This allows too much time for man and nature to alter the face of the land. Roads and buildings are constructed, land is cleared or abandoned, forests grow, are cut or burned, dams are built, and lakes are formed. Like a 10-year-old car, such photography may still help you get around but it may let you down when you need it most. This danger is least in an extensively forested area where the only changes to be accounted for are the growth and removal of the trees. Using antiquated photos, however, is at best a guessing game.

Selecting the Route

You are probably wondering just how and why we selected this particular route into the plot. Why not follow the stream shown on the photo up to a point near the plot? What made this route more attractive than any other?

First, think of the things that make travel through the woods easy: (1) Distance—the less time we spend walking the better. (2) Topography—walking is easiest on level, dry ground. (3) Cover—walking in heavy timber is easier than stumbling through brush. (4) Compass lines—we prefer to guide ourselves by means of landmarks rather than follow a compass and drag a chain.

Here is where aerial photographs are of unequalled value. A reference point can be selected much nearer the plot from the photos than from a map. The entire line into the plot can be seen and compared with alternate routes. You need not use the tedious trial-and-error method to find out where to ford a stream, how to get around a cliff, or which side of a mountain has the gentlest slope; you simply explore the whole area by eye and determine the best way before starting out. Besides avoiding obstacles, you can take advantage of any woods roads, trails, and landmarks that will aid you in getting to your destination. Our route was chosen because it looked high and dry and easy to follow.

Choosing a Reference Point

At the mouth of the hollow we emerge from the woods onto an open flat next to the stream. A pair of large spruce trees stand in the small brushy area to our left in

the loop of the stream (Point *T*). There is no mistaking these, so once again we have checked our position and know exactly where we are. Directly across the stream there are two small hills separated by a low saddle. We have previously chosen the kettle hole behind the hill on the left as our last reference point. The photos reveal a group of five fairly large trees in the shape of a cross at the bottom of this hole. We will mark and begin chaining from one of these.

If this were to be a permanent plot, and we intended to revisit it after an interval of 5 or 10 years, we would have chosen one of the sharp bends in the stream as our reference point. Although this would have meant a slightly longer chaining job, such a point is less susceptible to change and would be easier to relocate in the future. However, since this is primarily a demonstration, we chose one of the trees in the kettle hole mentioned above to show what can be done with aerial photos. At the present time, an experienced forester would have little difficulty locating this depression in the woods and identifying the trees on the ground. But as time passes, the brush will grow up and make the larger trees that are now so conspicuous harder to find. Then too, there is always the danger of our reference tree being cut or destroyed in logging.

The main point to consider when you are selecting a reference point is whether you or anyone else expect to return to the plot. If so, it is more important to have a permanent, easily relocated reference point than it is to shorten your compass line by a few chains. For permanent plots, always try to locate reference points that are sure to remain prominent for some time. Choose poorly formed sound trees; do not pick trees that may be cut or rot away before you return to the plot. Ours is a temporary plot, though, so we want to get as close to it as possible before resorting to compass and chain.

Plotting and Running the Compass Line

By now we have climbed over the saddle, dropped into the kettle hole, and found the reference tree. The next step is to draw a line on the photo from the reference point to the plot center and extend it to intersect the bearing line. Then lay a protractor on the photo so that bearing line *AB* coincides with the 84° mark on the protractor. (This, you may recall, was the direction of the bearing line.) Now we can read the direction of our compass line directly from the protractor. Then, using a 1/50-inch scale, we measure the distance between the two points and multiply by the previously determined factor (0.508). Thus we find that the distance is 8.13 chains and the bearing is S 10° W.

The photos show that the line runs steeply up out of the depression for a short way, then levels off, and finally climbs to the top of the hill. Do not worry about checking the line too closely for this short distance. We should have little difficulty checking our location on the ground with the features that are apparent on the photos. The end of the line should bring us just about to the summit of the hill in a stand of small hardwood pole-timber trees. Just beyond and to the right of plot center the trees should be a little larger.

On longer chaining jobs the line should be checked frequently by comparing ground features with photo images. Such factors as changes in timber type and size, direction and degree of slope, the place and angle at which a stream or ridge is crossed all serve as checks on the progress and accuracy of the line. This system of continuous checking may also be used to great advantage in strip or line-plot cruising. Sometimes the position of a conspicuous feature in relation to the line may indicate a deviation from the desired course, and a new bearing can be plotted, using that point as a supplementary reference point.

When our measurements, studies, or observations on the plot have been completed, we can return to the car by another route and see a little more of the country. Put away your compass, scale, and protractor; you won't need them any more. Just meander along in any direction and for as long as you please. Whenever you have any doubt about where you are, simply take to the air and look down at yourself and the surrounding countryside through the camera's eye. It's easier if you orient the picture with the lay of the land. And the whole process is easier than you think.

This background material should enable you to begin using aerial photographs to advantage in the field. As your experience and ability increase, many of you will find ways to adapt some of these concepts to your own particular needs. Moreover, once you have mastered the basic techniques, you can use photos to help you plan logging operations, locate roads and trails, fight and map forest fires, and do other specialized jobs in the woods.

The Effect of Compass Direction on the Measurement of Diameter Breast High of Shortleaf Pine

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IT IS FREQUENTLY STATED in cruising instructions that all diameters breast high shall be measured in two directions, at right angles, and that the average of these two measurements shall be considered as the true diameter breast high. The purpose of this rule is to overcome the difficulty with elliptical trees, although few experienced timber cruisers adhere to these instructions because of the time involved, the necessity for continuous mental calculations, and because many use the diameter tape as the instrument for diameter measurement.

However, because of the eccentricity of tree boles there is a sound basis for the rule in regard to single tree measurements. Many trees are obviously elliptical. Others, not so obviously elliptical have been reported by Heck (*3*) as always seeming to average somewhat smaller in a north-south direction than in an east-west direction. If Heck's observations hold true for all localities, and if the difference is great enough to be of importance in practical work, or statistically significant in research work, then the rule regarding right angle diameter determinations at breast height should be adhered to, or possibly altered to account for variations due to compass direction.

Method of Study

In an effort to obtain an answer to this problem for one species and in one vicinity, 1,021 shortleaf pine (*Pinus echinata*) trees were measured on the Oconee Forest, of the School of Forestry, University of Georgia. All measurements of diameter breast high outside bark were taken with calipers. Two measurements, one in an east-west direction and the other in a north-south direction, were taken on each tree. Before each measurement was taken a pocket compass was used to determine true direction, and a stick 4.5 feet long was placed against the side of the tree to insure that each measurement was taken at exactly breast height. Trees standing on sloping ground were measured at 4.5 feet above the average ground level.

All diameter measurements were taken to the nearest 0.1 inch in both an east-west and north-south direction. Later, the trees were classified into one-inch diameter classes, but the tenth-inch measurements were retained. The trees ranged in size from the 6-inch to the 15-inch class, inclusive, with all one-inch classes between 6 and 15 inches being represented. A statistical analysis was made according to the method described by Girard and Gevorkiantz (*2*), and Bruce and Schumacher (*1*), to determine if an adequate number of trees had been obtained in each diameter class. In all cases, less than 100 trees were determined to be adequate in each diameter class. In each diameter class, more than the required number were tallied.

Results

The field data of the study were grouped in four different ways, and a statistical analysis was made of each grouping to determine if the north-south diameters were significantly different from the east-west diameters.

1.—By one-inch diameter classes.

2.—By cordwood classes: Including all trees from 6 to 9 inches d.b.h., inclusive.

3.—By sawtimber classes: Including all trees from 10 to 15 inches d.b.h., inclusive.

4.—By all classes: Including all 1,021 trees in one group.

In each of the above groupings, no statistically significant difference was found at the one percent level.

As for the actual measurements, in five of the individual one-inch classes, namely the 6, 7, 8, 12, and 15 inch classes, the average diameter of the trees in each class was greater in an east-west direction than in a north-south direction. In the remaining one-inch classes, the average diameter was greater in a north-south direction than in an east-west direction.

In the cordwood-sized and sawtimber-sized group, the average diameter was greater in an east-west than in a north-south direction. The same results were obtained when all of the 1,021 trees were grouped together.

In all groupings, the differences in average diameters between east-west and north-south measurements were one-tenth of an inch or less.

Conclusions

The results of this study substantiate, in a large measure, Heck's (*3*) observations; namely, that the average diameters of trees is smaller in a north-south direction than in an east-west direction. This proved to be true, in this study, when the trees were classified into cordwood, sawtimber, and cordwood-sawtimber sized groupings. It did not, however, prove consistently true among individual classes.

Statistical analysis of the data of this study, also shows that the differences, even though they exist were in no case statistically significant. In all cases the average difference was one-tenth of an inch or less.

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Plotless Timber Estimates—New, Fast, Easy

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This article describes a method for estimating basal area quickly and accurately by merely counting trees, without measuring diameters or distances from the sampling point. Estimates of volume, stand structure, and stocking are also easily obtained.

A RAPID METHOD of sampling tree basal area per acre and related figures, devised by Bitterlich[1] several years ago, has been overlooked in this country though widely publicized in Europe. This method does not require measurement of plot radius or tree d.b.h. to estimate basal area per acre. Points on the ground are classified instead.

In using the method, the cruiser views the d.b.h. of every tree visible from a set of points or locations selected on the area in question in an unbiased manner. He counts the number of d.b.h.'s appearing larger than a simple hand-held angle-gauge or optical fork. Figure 1 illustrates the principle. Dividing the count by the number of sample points and multiplying by a constant factor will estimate average basal area per acre. The usual timber survey statistics may be derived by special procedures.

Operating Principles

The system merely adapts to field use the point-sampling technique familiar to all foresters who have ever counted dots on an overlay of a map or photograph. In order to understand why the system works, assume that a stand of trees has been mapped to scale, showing only the cross section of each tree at breast height. Using an overlay, count the number of dots which fall inside tree cross-sections and divide by the total number of overlay dots. This estimates the average number of trees per dot, or $\frac{\text{tree basal area}}{\text{land area}}$. This figure multiplied by 43,560 square feet estimates basal area in square feet per acre.

Now encircle each mapped tree with a larger circle whose diameter is 66 times tree d.b.h. In most stands there will be numerous overlapping circles. Count the number of circles which enclose overlay dots (even though several circles may enclose the same dot) and divide by the total number of overlay dots. This estimates the average number of circles per dot, or $\frac{\text{circle area (crediting laps)}}{\text{land area}}$. Dividing by the square of 66 (or 4,356) reduces this to $\frac{\text{tree basal area}}{\text{land area}}$, and multiplying by 43,560 square feet again estimates basal area in square feet per acre. Note that the last two operations are equivalent to multiplying the average number of circles per dot by $\frac{43{,}560}{4{,}356}$ or 10. Such a multiplier is called a "basal area factor." In the first example, where only the trees' own cross-sections were involved, the basal area factor was 43,560.

In actual field application, the map and dot overlay discussed above are replaced by a stand of timber and a set of locations or points which are visited by the cruiser. To determine how many large concentric circles (with diameter 66 times tree d.b.h.) enclose these points, the cruiser stands at each point and counts trees whose breast high cross-sections subtend angles larger than 104.18

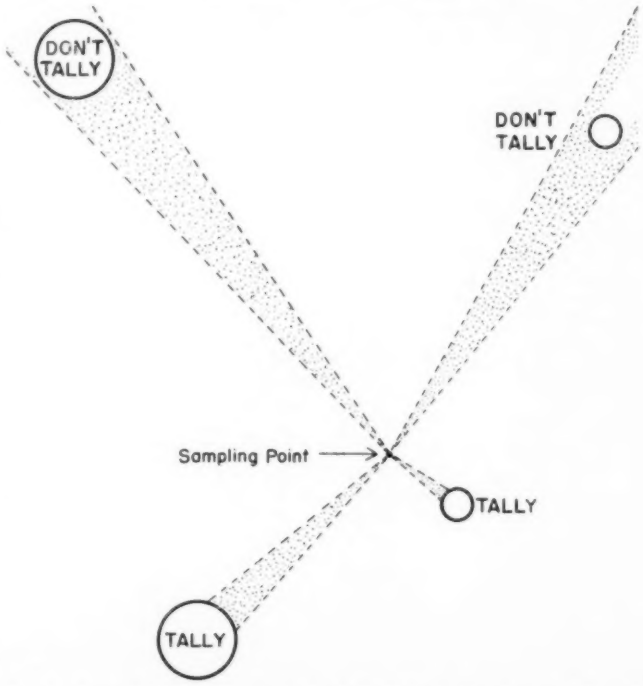

FIG. 1.—How point sampling works in the field. Circles represent cross sections of trees at breast height, shaded areas indicate angle-gauge projections from sampling point.

[1]Bitterlich, W. Die winkelzählprobe. Allgemeine Forst und Holzwirtschaftliche Zeitung 59 (1/2): 4-5. 1948.

minutes. This last angle is the "critical angle" which just includes a circle at a distance of 33 times its diameter. The count of trees subtending angles larger than this critical angle is exactly equivalent to the count of trees closer to the sampling points than 33 times tree diameter. The figure 33 is called the "plot radius factor." It is more commonly expressed as $\frac{33}{12}=2.75$ when tree d.b.h. is measured in inches and plot radius in feet. Since the size of each large concentric circle varies with d.b.h., the entire sampling technique is sometimes called the "variable plot radius method." The probability that any tree will be included in the count is proportional to its basal area.

Instrument for Establishing Critical Angle

Woods application of this method requires only a simple instrument to gauge the critical angle. It can be made from a wooden rod with a peephole mounted on one end and a metal crossarm fixed on the other (Fig. 2). To establish an angle of 104.18 minutes, the crossarm should be 1 inch long if its distance from the eye (the optical base)is 33 inches. This ratio of $\frac{1}{33}=.0303$ is called a "crossarm length factor." Other crossarm lengths or eye distances can be used to define this angle as long as they preserve the appropriate $\frac{1}{33}$ ratio, but distances much shorter than 33 inches are impractical because of the impossibility of keeping both crossarm and tree in focus simultaneously.

The presentation above has assumed a critical angle of 104.18 minutes, with basal area factor 10, plot radius factor 2.75, and crossarm length factor .0303. Different critical angles with different factors might be used if desired. Table 1 gives a wide selection, but use of angles smaller than 104.18 minutes is not advised except in open stands, because the narrower the angle the

TABLE 1.—CONVENIENT CRITICAL ANGLE GAUGES

Critical angle	Cross-Arm Length Factor (multiply by distance between eye and cross arm to get cross arm length)	Basal Area Factor (multiply by average number of trees counted per point to get basal area in sq. ft. per acre)	Plot Radius Factor (multiply by d.b.h. in inches to get corresponding plot radius in feet)
Minutes			
32.94	0.0096	1	8.696
46.59	.0136	2	6.149
52.09	.0152	2 1/2	5.500
57.06	.0166	3	5.021
60.15	.0175	3 1/3	4.763
65.89	.0192	4	4.348
73.66	.0214	5	3.889
104.18	.0303	10	2.750
127.59	.0371	15	2.245
147.34	.0429	20	1.944
164.73	.0479	25	1.739
180.46	.0525	30	1.588
190.22	.0553	33 1/3	1.506
194.92	.0567	35	1.470
208.38	.0606	40	1.375
221.02	.0643	45	1.296
232.99	.0678	50	1.230
244.36	.0711	55	1.173
255.23	.0743	60	1.123
265.66	.0773	65	1.079
275.69	.0802	70	1.039
285.37	.0831	75	1.004
294.74	.0858	80	.9723
303.82	.0884	85	.9432
312.63	.0910	90	.9167
321.20	.0935	95	.8922
329.55	.0959	100	.8696
345.65	.1006	110	.8292
361.04	.1051	120	.7939
375.79	.1094	130	.7627
389.99	.1136	140	.7350
403.70	.1176	150	.7100
416.95	.1214	160	.6875
429.80	.1252	170	.6670
442.28	.1288	180	.6482
454.42	.1324	190	.6309
466.24	.1358	200	.6149

TABLE 2.—CONVENIENT MIL SCALE GAUGES

Cross arm extent	Basal Area Factor (Multiply by average number of trees counted per point to get basal area in square feet per acre)	Plot Radius Factor (Multiply by d.b.h. in inches to get corresponding plot radius in feet)
Mils		
5	.272	16.667
10	1.089	8.333
15	2.450	5.556
20	4.356	4.167
25	6.805	3.334
30	9.799	2.778
35	13.336	2.381
40	17.417	2.084
45	22.041	1.852
50	27.208	1.667
55	32.917	1.516
60	39.169	1.390
65	45.962	1.283
70	53.295	1.191
75	61.170	1.112
80	69.585	1.043
85	78.539	.9813
90	88.030	.9269
95	98.061	.8782
100	108.628	.8344

FIG. 2.—Simple instrument for establishing critical angle.

TABLE 3.—HYPOTHETICAL VOLUME TABLE (MESAVAGE-GIRARD FORM CLASS 80)

D.b.h.	Merchantable length in 16-foot logs 1	2	3	4	Tree basal area
Inches	*Bd. ft. vol. (Int. ¼" rule)*				*Sq. ft.*
10	39	63	—	—	0.545
12	59	98	127	—	0.785
14	83	141	186	216	1.069
16	112	190	256	305	1.396
18	144	248	336	402	1.767
20	181	314	427	512	2.182

TABLE 4.—RATIOS OF TREE VOLUME TO 10 TIMES TREE BASAL AREA

D.b.h. (inches)	Merchantable length in 16-foot logs 1	2	3	4
	Int. bd. ft.÷(10)(basal area in sq. ft.)			
10	7	12	—	—
12	8	12	16	—
14	8	13	17	20
16	8	14	18	22
18	8	14	19	23
20	8	14	20	23

greater the need for unobstructed visibility. If eye glasses prevent the eye from being placed in contact with the peephole, the true optical base will have to be calculated and used instead of peephole distance.

A more refined version of the instrument is a prismatic monocular (not over 7-power) with an internal caliper device or a mil scale graduated at 5-mil intervals. Table 2 furnishes factors appropriate to such a device. Each sample point should be kept one focal length in front of the objective glass of this instrument (cf. stadia optical theory).

Basal Area Determination

To estimate basal area per acre for a stand, the cruiser simply visits a set of points or locations, the number depending on the desired intensity of the survey. At each point he counts every tree whose d.b.h. appears larger than his instrument crossarm when viewed through the peephole. He then gets basal area per acre by multiplying the average number of trees per point by the basal area factor.

For example, assume that 5 points are visited and 40 trees in all are counted, using a critical angle of 104.18 minutes. The average of 8 trees per point multiplied by 10 gives a basal area estimate of 80 square feet per acre. If the ground at a location slopes, the count for that location is multiplied by the secant of the angle of slope perpendicular to the contour. An average slope correction for the average count may be used if there is little correlation between count and slope.

The precision of the basal area estimate depends on the variance (V) of counts (X) at each of (N) points. When the points are random, $V = \frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N-1}$, and the standard error of the mean count $= \sqrt{\frac{V}{N}}$. If the total count of 40 trees assumed in the preceding example is comprised of counts of 4, 10, 6, 10, and 10 at 5 points, then the mean is 8, V= 8, and the fiducial limits for 1 standard error of the mean are 8 ± 1.265 counts, or 80 ± 12.65 square feet of basal area per acre.

Volume Per Acre

The estimate of volume per acre requires that suitable volume tables be converted to $\frac{\text{volume}}{(10)\ (\text{basal area})}$ ratio tables. Recording d.b.h. and merchantable height of trees counted as before allows computation of the mean $\frac{\text{volume}}{(10)\ (\text{basal area})}$ ratio, which when multiplied by 10 gives average volume per square foot basal area. Basal area per acre is then multiplied by this figure to get volume per acre.

Suppose Table 3 were representative of the timber in question (cubic feet or other units might be used instead of board feet). It is converted to the $\frac{\text{volume}}{(10)\ (\text{basal area})}$ ratio table shown in Table 4 by dividing each volume by 10 times the appropriate basal area

If all the 40 trees tallied at the 5 locations have been classified by d.b.h. and number of logs, the appropriate ratios can then be inserted from Table 4, and the rest of the calculation carried out as indicated in Table 5. Obviously, a slight improvement in accuracy

TABLE 5.—HYPOTHETICAL POINT-SAMPLE FIELD TALLY SHEET

Point #1		Point #2		Point #3		Point #4		Point #5		Total	
D.b.h. and no. of logs	Ratio	D.b.h. and no. of logs	Ratio	D.b.h. and no. of logs	Ratio	D.b.h. and no. of logs	Ratio	D.b.h. and no. of logs	Ratio	Item count	Ratio sum
6·0	0	10·1	7	10·1	7	16·3	18	14·2	13		
12·1	8	18·3	19	2·0	0	10·1	7	16·3	18		
16·3	18	14·2	13	20·4	23	10·1	7	18·3	19		
20·4	23	6·0	0	18·4	23	12·1	7	16·3	18		
		16·4	22	12·2	12	12·2	12	8·0	0		
		10·2	12	18·3	19	10·1	7	10·1	7		
		8·0	0			14·2	13	12·1	7		
		8·0	0			14·2	13	12·2	12		
		12·2	12			14·2	13	10·1	7		
		14·2	13			8·0	0	4·0	0		
Item count	4		10		6		10		10		40
Ratio sum	49		98		84		97		101		429

TABLE 6.—HYPOTHETICAL POINT-SAMPLE FIELD TALLY SHEET (SIMPLIFIED BY OMISSION OF D.B.H.)

Number of logs	Point #1	Point #2	Point #3	Point #4	Point #5	Subtotal	Assumed average ratio	Product
	Tree count							
0	1	111	1	1	11	8	0	
1	1	1	1	1111	111	10	7	70
2		1111	1	1111	11	11	13	143
3	1	1	1	1	111	7	18	126
4	1	1	11			4	23	92
Total	4	10	6	10	10	40		431

could be achieved by not rounding the ratios, but the gain is rarely enough to justify the extra work of carrying another digit in all calculations. Local sampling to establish the ratios directly would, of course, be better than deriving them from a volume table not based on the timber being sampled.

The product total may be treated as the total ratio sum in the preceding example. A short cut is available when, as in the present case, basal area and ratio estimates are based on the same tally.

$$\text{Average volume per acre} = \left(\frac{\text{product total}}{\text{total number of points}}\right)(\text{B.A. factor})\ (10)$$

$$= \left(\frac{431}{5}\right)(10)\ (10) = 8{,}620 \text{ bd. ft. (Int. log rule)}.$$

From Table 5:

$$\text{Average ratio} = \frac{\text{Total ratio sum}}{\text{Total tree count}} = \frac{429}{40} = 10.7.$$

Average volume per square foot of basal area = (10) (average ratio) = 107 bd. ft. (Int. log rule, ¼ inch kerf).

$$\text{Average basal area per acre} = \left(\frac{\text{Total tree count}}{\text{Number of points}}\right)(\text{B.A. factor}) = \left(\frac{40}{5}\right)(10)$$

$$= 80.0 \text{ sq. ft.}$$

Average volume per acre = average basal area in sq. ft. per acre × average volume per sq. ft.

$$= (80)\ (107) = 8{,}560 \text{ bd. ft. (Int. log rule, ¼ inch kerf)}.$$

The procedure may be easily elaborated to provide greater accuracy, or simplified for the sake of speed. An obvious adaptation is to use a larger critical angle to obtain a smaller sample of the average ratio, while using a smaller critical angle to obtain a larger sample of average basal area per acre.

An even greater simplification can be obtained by disregarding the relatively slight ratio variation within the individual length classes (seen in Table 4) and using local average ratios as though they were constant within a merchantable length class, thus: 7 for one-log trees, 13 for two-log trees, 18 for three-log trees, 23 for four-log trees. This eliminates the need for estimating and recording d.b.h.; merchantable length alone is tallied. Table 6 shows how such a process simplifies tally and volume calculations with little sacrifice of accuracy if average ratios for merchantable length classes are sample-based or judiciously selected.

When estimate of sampling precision or variability between locations is not desired, there is no need to record item counts separately for each location, and a very compact tally sheet can be devised. For most purposes, however, it will be desirable to record data from each location individually, as in Tables 5 or 6.

Stand Structure

A point-sample field tally showing the tree count by diameter classes can be converted to basal area in each diameter class if each count is multiplied by $B = \frac{\text{basal area factor}}{\text{number of points}}$. Division of these basal areas by the basal area of a tree at nominal class midpoint will give the conventional stand table.

In Table 5, 40 trees were counted and classified into 2-inch d.b.h. groups at five locations. The counts —disregarding larger trees for the moment—were one 2-inch tree, one 4-inch tree, and two 6-inch trees. Then $B = \frac{10}{5} = 2$, and basal area per acre would be estimated as 2.0 square feet in 2-inch trees, 2.0 square feet in 4-inch trees, and 4.0 square feet in 6-inch trees. Number of trees per acre would be $\frac{2}{.0218}$ = 91.7 2-inch trees, $\frac{2}{.0873} = 22.9$ 4-inch trees, and $\frac{4}{.1963} = 20.4$ 6-inch trees, etc.

This procedure will compute a satisfactory stand table, but it is not well adapted to calculating mean d.b.h., d.b.h. of tree of mean basal area, or their standard deviations. Table 7 uses the hypothetical diameter distribution of all 40 trees counted at 5 points to illustrate how certain essential intermediate quantities may be calculated while deriving a stand table. The sample counts within each class are shown in the second column (headed "Original count or GfD^2"). Each is then multiplied successively by appropriate D, D^2, $\frac{1}{D}$, $\frac{1}{D^2}$, with the product recorded in Columns 3, 4, 5, and 6. All entries in the second column are multiplied by $B = \frac{\text{basal area factor}}{\text{number of points}}$ to produce the eighth column, which gives the stand in terms of basal area per acre in each diameter class, and all entries in the sixth column are multiplied by $\frac{1}{G} = \frac{B}{.00545415}$ to produce the seventh column, which gives the stand in terms of number of trees per acre in each diameter class.

The various totals at the bottom of columns 2 through 6 can be used to get such descriptive elements of individual tree distribution in size as the mean d.b.h., mean basal area, or d.b.h. of tree of mean basal area,

and the standard deviations of mean d.b.h. and mean basal area:

$$\text{Mean d.b.h. (per tree)} = \frac{G\Sigma fD}{G\Sigma f} = \frac{4.0299}{.6265} = 6.432 \text{ inches.}$$

$$\text{Mean basal area (per tree)} = \left(\frac{G\Sigma fD^2}{G\Sigma f}\right)(.005454) = \left(\frac{40}{.6265}\right)(.005454) = (63.85)\,(.005454)$$

$$= .348 \text{ square feet.}$$

$$= \frac{\text{B.A. per acre}}{\text{No. trees per acre}} = \frac{80}{229.7} = .348 \text{ square feet.}$$

The second of these two estimates of mean basal area is more apt to contain rounding errors than the first.

$$\text{D.b.h. of tree of mean basal area} = \sqrt{\frac{G\Sigma fD^2}{G\Sigma f}} = \sqrt{63.85} = 7.99 \text{ inches}$$

$$\text{Standard deviation of d.b.h.} = \sqrt{\left[\frac{G\Sigma fD^2}{G\Sigma f} - \left(\frac{G\Sigma fD}{G\Sigma f}\right)^2\right]\left[\frac{G\Sigma fD^2}{G\Sigma fD^2 - 1}\right]}$$

$$= \sqrt{[63.85 - (6.432)^2]\left[\frac{40}{39}\right]} = \sqrt{(63.85 - 41.7)\left(\frac{40}{39}\right)}$$

$$= \sqrt{(22.48)(1.026)} = \sqrt{23.06} = \pm 4.80 \text{ inches.}$$

$$\text{Standard deviation of basal area} = \left(\sqrt{\left[\frac{G\Sigma fD^4}{G\Sigma f} - \left(\frac{G\Sigma fD^2}{G\Sigma f}\right)^2\right]\left[\frac{G\Sigma fD^2}{G\Sigma fD^2 - 1}\right]}\right)(.005454)$$

$$= \left(\sqrt{\left[\frac{6708}{.6265} - (63.85)^2\right][1.026]}\right)(.005454)$$

$$= \left(\sqrt{(10{,}707 - 4{,}077)(1.026)}\right)(.005454)$$

$$= \left(\sqrt{6{,}802}\right)(.005454) = \pm .450 \text{ square feet}$$

distribution of a stand, the point-sample technique can be used to calculate statistics describing the spatial distribution of basal area much more easily than is possible by conventional methods.

A basal area clustering coefficient (Q) for a given critical angle is obtained by dividing the earlier obtained variance (V) of the individual tree counts by the mean (X). The five individual counts used earlier would give $Q = \frac{V}{X} = \frac{8}{8} = 1.00$. This, of course, could also be calculated from a plot cruise, but would require tedious basal area calculation on each individual plot.

When Q is larger than 1 it indicates a contagious population where basal area is spatially clustered more tightly than would occur by pure chance. This is characteristic of patchy plantations or spotty stocking in older stands. Where Q is smaller than 1 it indicates that basal area is spatially distributed more evenly than would occur by

Often the much simpler calculation of order statistics from the original point-sample count arrayed by d.b.h. will be preferable to this somewhat tedious calculations of statistics for individual tree distribution in size. These order statistics require only that the three quartiles of the array illustrated by the first two columns of Table 7 be located. They occur at 9.5, 12.1, and 15.4 inches. From them it can be estimated by conventional formulae: (1) that the median basal area ordinate occurs at 12.1 inches d.b.h. (half of the basal area is in trees of larger size), (2) that the coefficient of quartile skewness with respect to basal area is + 24 percent (positive sign implies greater spread of basal area among larger sizes than among smaller), and (3) that the coefficient of interquartile variation with respect to basal area is ± 24 percent (relatively large variation implies all-aged appearance).

In addition to yielding familiar statistics describing the size-class

TABLE 7.—DERIVATION OF STAND TABLE FROM POINT-SAMPLE FIELD TALLY

Point-sample field tally		Intermediate calculations				Stand table	
D.b.h. class or D	Original count or GfD²	DxCount or GfD³	D²xCount or GfD⁴	Count / D or GfD	Count / D² or Gf	Number per acre or f	B.A. per acre or BGfD²
Inches	*No. of trees*					*No. of trees*	*Sq. ft.*
2	1	2	4	0.5000	0.2500	91.7	2.00
4	1	4	16	.2500	.0625	22.9	2.00
6	2	12	72	.3333	.0555	20.4	4.00
8	4	32	256	.5000	.0625	22.9	8.00
10	8	80	800	.8000	.0800	29.3	16.00
12	7	84	1,008	.5833	.0486	17.8	14.00
14	6	84	1,176	.4286	.0306	11.2	12.00
16	5	80	1,280	.3125	.0195	7.2	10.00
18	4	72	1,296	.2222	.0123	4.5	8.00
20	2	40	800	.1000	.0050	1.8	4.00
Totals	40	490	6,708	4.0299	.6265	229.7	80.00

N = Number of points at which count is tallied = 5.0.

$$B = \frac{\text{Basal area factor}}{N} = \frac{10}{5} = 2.0.$$

$$G = \frac{.00545415}{B} = \frac{.00545415}{2.0} = .00272707.$$

$$\frac{1}{G} = \frac{B}{.00545415} = \frac{2.0}{.00545415} = 366.69$$

pure chance, usually because of uniform sprouting, seeding, planting, or natural mortality occurring in excessively dense clusters. When Q approaches 1, a random or Poisson population is suggested. Thus Q alone serves as a useful estimate of the degree of contagion detected by a given critical angle.

If the quantity $K = \frac{\overline{X}}{\overline{Q-1}}$ tends to remain constant when critical angle (and hence $\overline{X}$) is varied, the negative binomial distribution[2] may be valid for predicting the proportion of "unstocked" locations for any hypothetical density which might be selected, even though such hypothetical density might be associated with a different critical angle from any used in the field. Thus, the index (K) of the negative binomial if constant, may serve as a useful measure of spatial contagion independent of density or critical angle. It would be very difficult to test the hypothesis of a negative binomial distribution using conventional plot cruising methods.

The negative binomial distribution is specified by $(Q-P)^{-K}$, where Q and K are defined as above, and where $P = Q - 1 = \frac{\overline{X}}{K}$. The probability of a zero count in such a distribution is $P_{(0)} = Q^{-K}$, and the probability of any specified count (R) is

$$P_{(R)} = \binom{K+R-1}{R} \left(\frac{Q-1}{Q}\right)^{R} \left(\frac{1}{Q}\right)^{-K}$$

where

$$\binom{K+R-1}{R} = \frac{(K)(K+1)\ldots(K+R-1)}{(1)\ (2)\ \ldots(R)}$$

The variance (V) of a sample from such a distribution is an estimate of KPQ. After calculating Q and K from counts, the agreement of predicted $P_{(0)}$ with observed $P_{(0)}$ may be used as a coarse test of fit, or chi square may be used to test departure from expectation for all (R + 1) categories.

Minimum Satisfactory Stocking and Operability

A location may be classified as falling in an area where commercial operations are feasible or where regeneration is currently unnecessary when there are one or more merchantable trees within some variable distance in feet equal to an arbitrary plot radius factor times d.b.h. in inches (for instance, 1.5 d.b.h.). No milacre tally of small trees need be made when any merchantable tree is near enough to exceed the corresponding critical angle (about 190.3 minutes in the above case, entering Table 1 with plot radius factor 1.5, and reading the corresponding critical angle).

Such a specification of satisfactory stocking condition has considerable merit, since it not only can be determined optically without leaving the point, but also implicitly allows larger trees more growing space and defines the minimum basal area of merchantable growing stock per acre considered satisfactory (about 33⅓ square feet per acre in the above case, entering Table 1 with plot radius factor 1.5, and reading the corresponding basal area factor).

[2]Anscombe, F. J. The statistical analysis of insect counts based on the negative binomial distribution. Biometrics 5:165-173. 1949.

Robert K. Winters Replaces A. C. Cline on Editorial Board

Robert K. Winters of Columbus, Ohio, has been appointed associated editor of the JOURNAL OF FORESTRY for the field of economics and policy replacing Albert C. Cline of Washington, D. C. Mr. Cline, who is chief of the Foreign Forestry Branch of the Division of Economics, U. S. Forest Service, has capably served as associate editor since January 1948. He has relinquished the position because of heavy pressure of official duties.

Mr. Winters is in charge of economics research at the Central States Forest Experiment Station. He has had many years of experience in writing and editing, and was chairman of the committee of authors who wrote the book *Fifty Years of Forestry in the U.S.A.* published by the Society of American Foresters in connection with the Society's fiftieth anniversary in 1950.

Notes

Measuring White Oak Stave Bolts

Throughout Missouri the better-quality portions of large white oak trees are often utilized for staves. Smaller quantities of overcup, oak, swamp chestnut oak, swamp white oak, and occasionally post oak are also used. Bolts are quarter-sawn into staves on special saws and into header stock for both slack and tight cooperage. Bourbon whiskey barrels require staves free from most defects.

In general, specifications for cooperage stock require straight bolts cut from live trees, free from knots, rot, worm holes, and twisted grain. Staves not meeting specifications for Bourbon barrels are often acceptable for barrels to hold other liquids. Suitable parts of white oak trees, usually the clear butt log, are sawed into sections which are either sawed or split with wedges and maul into quarters or pie-shaped bolts. During the winter months sections are cut 37 inches in length, but during the summer months they may be cut as long as 39 inches to permit greater trimming required by more severe end-checking. For tight cooperage stock only the heartwood portion of the bolt, with its springwood pores occluded with tyloses, is suitable for retaining liquids of low viscosity without excessive soaking into the wood. Some specifications admit bolts with 4 or more inches of heartwood measured on the radial surface of the bolt but others require 8 or more inches of heartwood.

A measure of the amount of heartwood in a bolt, then, is desired, and the chord foot as a unit of measure has been developed by the cooperage industry for this purpose. This choice of name, though descriptive, is unfortunate because confusion with the cord as a unit of measurement of stacked wood is frequent. A better name might be *stave foot*. The measurement is made from a point on one edge of the cross-section surface where heartwood and sapwood meet to the same point on the other edge. The tape is held as a chord from one point on the circumference of the circular area of heartwood to another point on the circumference of the heartwood. A chord line 15 inches in length would be measured as 1.25 chord feet. In some localities, especially during periods of great demand for stave bolts, the chord measurement is commonly taken to include sapwood or even sapwood and bark. Such practice results in a larger chord foot measurement for a given size of bolt.

A scaler measuring bolts to determine the amount of payment for delivered bolts or wage payment for piece-work cutting measures across the first bolt. After marking the bolt to indicate that it has been measured he proceeds to the next one, accumulating successive measurements on the tape. The reading on the tape for the final bolt on the load is the total number of chord feet in the load. A 1½-ton truck loaded with 100 bolts often may contain 130 chord feet. At a price of $1.25 per chord foot, currently paid for bolts delivered to several loading points or mills, the payment would be $162.50.

As a measure of usable volume the chord foot appears to have some merit. The cross-section area of heartwood in a stave bolt approximates that of a sector of a circle whose area can be computed from the equation: $A = \frac{1}{2} r^2\theta$, where

A = area of a sector of a circle
r = radius
θ = angle in radians subtended by a chord of given length.

An equation of the second degree, its inflection when expressed graphically is small over the range of combinations of chord lengths and radii commonly encountered in stave bolts. Therefore, cross-section area and volume of bolts vary approximately directly with length of chord.

Peck, Sechrist, and Leach[1] reported that the number of chord feet in standing white oak trees may be estimated by use of the following equation: $N = \frac{D + d}{2}(h)\,(0.072)$, where

N = number of chord feet
D = diameter of tree at breast height
d = top limit of merchantability, about 12 inches minimum diameter, or to first limbs or visible evidence of defect
h = height in feet from a 1.0 to 1.5 foot stump to the top limit of merchantability.

Table 1 is based on this equation. Field checks by L. E. McCormick, extension forester for Missouri, indicated the value in Table 1 to be from 0 to 3 percent low.

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TABLE 1.—MERCHANTABLE VOLUME OF WHITE OAK STAVE BOLT TREES

D.b.h. inches	Number of 39-inch cuts							
	1	2	3	4	5	6	7	8
	Chord feet[1]							
12	2.8							
14	3.3	6.4						
16	3.7	7.4	10.9					
18	4.2	8.3	12.3	16.2				
20	4.7	9.2	13.7	18.0	22.2	26.3		
22	5.2	10.2	15.1	19.9	24.6	29.1	33.6	
24	5.6	11.1	16.5	21.8	26.9	31.9	36.9	41.6
26	6.1	12.0	17.9	23.6	29.2	34.8	40.1	45.4
28	6.6	13.0	19.3	25.3	31.3	37.2	43.0	48.7
30	7.0	13.9	20.7	27.4	33.9	40.4	46.7	52.9
32	7.5	14.9	22.1	29.2	36.3	43.2	50.0	56.6
34	8.0	15.8	23.5	31.1	38.6	46.0	53.2	60.4
36	8.4	16.7	24.9	33.0	41.0	48.8	56.5	64.1

[1]Assumes one-foot stump, ½ inch taper per cut.

[1]Peck, Ralph H., William C. Sechrist, and C. Willard Leach. Marketing Missouri farm timber crops. Mo. Agric. Expt. Sta. Bul. 460. Jan. 1943.

South Leads Nation in Pulpwood Production

The South now produces 60 percent of the total yearly U. S. cut of pulpwood, and also leads all other regions in mill capacity needed to convert the raw wood into pulp, according to a U. S. Forest Service report prepared by William S. Stover and released by the Southern Forest Experiment Station, New Orleans, and the Southeastern Forest Experiment Station, Asheville, N. C.

The South's 1950 pulpwood cut hit an all-time high of 12½ million cords (Table 1). Total U. S. cut in 1950 was 21 million cords.

Nine-tenths of the pulpwood being cut in the South is pine, but production of hardwood is increasing.

The 61 pulpmills now in operation in the South can produce 22,800 tons of pulp per day. This is about half of the nation's total wood pulping capacity.

New mills are under construction at Eastport, Fla., and at Acme, N. C., and five additional mills are planned. These new mills, together with expansions to existing mills, are expected to raise daily southern mill capacity to 29,000 tons.

TABLE 1.—PRODUCTION OF PULPWOOD AND PULP IN THE SOUTH

State	Number of mills	Mill capacity of pulp per day	Cords of pulpwood produced 1948	1949	1950	Counties with highest production
		Tons	*Thousand cords*			
Alabama	7	1,869	982	911	1,321	Baldwin, Mobile, Washington
Arkansas	2	810	617	561	604	Ouachita, Dallas
Florida	8	3,140	1,221	1,036	1,385	Nassau, Marion, Hamilton
Georgia	7	3,260	1,771	1,791	2,221	Bryan, Camden, Effingham
Louisiana	8	4,040	954	760	883	Union, Washington, Winn
Mississippi	6	2,087	1,434	1,168	1,666	Copiah, Jasper, Jones
N. Carolina	4	1,708	926	802	1,024	Onslow, Jackson, Bladen, Brunswick
Oklahoma	0		34	38	39	Leflore
S. Carolina	3	2,322	1,108	1,012	1,183	Georgetown, Fairfield, Berkeley, Horry
Tennessee	4	358	182	158	144	McMinn, Cocke, Monroe
Texas	2	970	824	791	922	Houston, Montgomery, San Augustine
Virginia	10	2,273	1,306	895	1,044	Buckingham, Brunswick, Amelia
Total	61	22,837	11,359	9,923	12,436	

Influence of Soil Microorganisms on Oak Growth

Inoculation of germinated acorns by certain microorganisms, isolated from the rhizosphere of a naturally-reproduced oak stand, stimulated the growth of oak seedlings in greenhouse cultures and on cut-over lands according to a recently reported study.[1] The best results were obtained when acorns were inoculated simultaneously with *Azotobacter* and *Trichoderma lignorum*. Such inoculation increased the growth of root systems and above-ground parts of seedlings from 20 to 40 percent as compared with check cultures. *Bac. Mycoides*, rhizospheric bacteria of a *Pseudomonas* type, and *Tieghemella glauca* failed to influence the growth.

The roots of oak seedlings inoculated with *Trichoderma lignorum* invariably developed ectotrophic mycorrhizae which were absent in all other cultures. Inoculation of acorns by soil, obtained from the roots of older oak trees, caused some stimulating effect on the growth of seedlings and led to slight development of ectotrophic mycorrhizae.

In the author's opinion the effect of *Azotobacter* and *Trichoderma lignorum* should be further investigated.

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[1]Malishkin, P. E. Influence of soil microorganisms on the growth of oak. Pochvovedenie 5:280-288, 1951, Moscow. (Communication from the Department of Soils, University of Saratov.)

Information Sought on Distribution of White Pine Pole Blight

Pole blight of western white pine (*Pinus monticola*) has now been found throughout most of the forests of the white pine type in the Inland Empire except on the Clearwater area in north Idaho. Approximately 10 percent of the areas of pole size white pine, 40 to 100 years old, have from moderate to severe pole blight. The Division of Forest Pathology is conducting a survey for this disease on funds provided by the Forest Pest Control Act. As a result of this survey, begun in the summer of 1949, affected stands have been delineated on maps and studies made of the progress of the disease. Pole blight has been found to be intensifying and spreading in some areas.

Pole blight has recently been found on western white pine on the British Columbia coast. Forest Pathological Notes Number 4, entitled *Pole Blight Recorded on the British Columbia Coast* by A. K. Parker, published by the Division of Forest Biology, Science Service, Dominion Department of Agriculture, at Victoria, B. C., in August 1951, describes this first known occurrence of pole blight in the coastal region of western North America. The presence of pole blight on the British Columbia coast increases the need for determining whether it occurs farther south, in the coastal areas of the United States.

The typical symptoms of pole blight are a shortening of the internodes and needle-bearing stems in the upper crown, together with yellowing, thinning, and shortening of needles. Flat faces are common on the boles of affected trees, and lesions, usually long and narrow, oc-

cur under the bark on the main stems. A copious resin flow from the lesions is one of the most characteristic symptoms of pole blight.

Please send reports of suspected pole blight on the Pacific Coast to the Division of Forest Pathology, Plant Industry Station, Beltsville, Maryland.

MARVIN E. FOWLER,
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Bureau of Plant Industry, Soils and Agricultural Engineering,
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Hardwood Forestry Shown Southern Executives

Over a hundred bankers, lumber mill executives, land managers, and landowners recently participated in a three-day tour which featured examples of accomplishments, possibilities, and problems in the South's 40,000,000 acres of hardwood forests. Starting in bluffland near Vicksburg, Miss., the tour was conducted to nine principal demonstrations in the three days. Before ending near Memphis, Tenn., it wound through the bluff areas and the wide variation of sites and types represented in the bottomlands.

The southern hardwood industry has long produced half of the hardwood lumber and veneer of the United States. To assure a continuous raw material supply it has become increasingly apparent that the hardwood timberlands must be scientifically managed. By far the major portion of this land is situated along the Mississippi River and its tributaries in a contiguous strip from Cairo, Ill., to a point above New Orleans, La. Most of the hardwood land is in the alluvial bottoms but some 4,000,000 acres of loessal bluff along the eastern edge of this "Delta" is also in hardwood forests.

Forestry in this broad type has lagged far behind that in the piney woods. However, in the last six years industry and the U. S. Forest Service have actively begun forest management and research. Interest in the possibilities is beginning to snowball.

There were two main purposes in the conduct of this tour: (1) To point out possibilities and opportunites of hardwood forestry and that it is already a soundly established activity on some lands, and (2) to put on exhibition to a policy-making group the actual practical nature of forestry undertaking in hardwoods.

Such an undertaking could not have been the success it was without the cooperative attitude and enthusiasm of its sponsors. These sponsors were the Delta Branch of the Southern Forest Experiment Station, the Mississippi Delta Council, the Illinois Central Railroad, Memphis Lumberman's Club, Anderson-Tully Company, Memphis Plywood Corporation, Chicago Mill and Lumber Company, Agriculture Committee of the Memphis Chamber of Commerce, U. S. Gypsum Company, Mississippi Bankers Association, and Southern Hardwood Producers, Inc.

With the assistance of company representatives and private landowners at the stop locations, J. A. Putnam, field spokesman of the tour, introduced the following main points for consideration and discussion by the group:

(1) Fire and intensive grazing have no place in hardwood management.

(2) Hardwoods on hardwood sites grow rapidly but must reach larger sizes than pine before merchantable for standard hardwood lumber or veneer logs. Average tree diameter growth in different stands was shown to vary from 2.5 to 6 inches in 10 years.

(3) Hardwood stands can be so managed as to adequately restock themselves. Reproduction areas are commonly mistaken for "brush" patches.

(4) With 32 merchantable species, wide variety of sites and types and peculiar utilization the ramifications of silviculture are many-fold. This indicated the need for responsible forest managers with experience and training in hardwoods. However, much can be done to increase the productivity of the forests by applying simple measures.

(5) Tremendous importance of integrated utilization and need of outlet for material of non-sawtimber size and quality.

(6) Need for practicing "early-and-often" thinnings in cottonwood and willow stands. At one stop on the tour a first thinning was being made of a 2500-acre willow stand. Before thinning this 25-year old willow stand averaged 40 cords per acre.

(7) Intensive timber stand improvement is required in almost all hardwood stands. The silvicultural value was evident at several stops but the practical extent to which this work can be carried on has yet to be determined.

Tolerance Is a Good Technical Term

There is some doubt as to whether tolerance has much value as a technical term. Baker (*1*) believes that many foresters are reluctant to use the term because it has become so debatable. He has offered the apology that although tolerance is not a scientific term it is still very useful. Tolerance does not need an apology. It *is* a scientific term. It could be just as precise and respectable as volatility, toxicity, solubility, conductivity, and similar technical terms. The only reason it now seems confused is that it has been abused. For some unknown reason foresters have tried to force the term to do more than other scientists ask of their terms, and in doing so they have stretched it into an uncertain and ever-changing shape. The damage, however, is easily reparable. If one simply follows the precedent established for these other technical terms, the confusion is dispelled.

The terms volatility, toxicity, etc., all have simple definitions. For example, volatility is the degree of being volatile. A volatile substance is one that vaporizes easily. Solubility is the degree of being soluble, etc. Following this precedent, tolerance can be defined simply as the *degree* of being tolerant. A tolerant species is one that tends to have a particular pattern of behavior—a pattern well known to most foresters. For example, a very tolerant species will show a strong successional tendency on mesic sites within its natural range, and will normally be an integral part of the climax community. Crowns will probably be dense with the lower branches long-lived, and height growth is likely to be slow.

Similarly, a very intolerant species will never be an integral part of the climax community on mesic sites. It will be represented in the climax by occasional relicts or isolated clumps and reproduction will be restricted to even-aged clumps on disturbed areas. Also, crowns will probably be thin with the lower branches short-lived, and height growth is likely to be rapid, except in heavy shade.

When tolerance is so defined it has great value to the teacher and student of forest ecology, for it allows an easy

description of the behavior of species of many regions. For example, when a student has become familiar with the behavior of beech or hemlock in local forests and associates "very tolerant" with this behavior, a simple statement that western redcedar, western hemlock, etc., are very tolerant should depict elaborately for him the behavior of these species in their respective ranges.

The trouble starts when somebody objects to the term by asking, "Tolerant *of what?*" But the "of what" is the first step in the explanation of the behavior described by "tolerant." Soluble only describes certain behavior, it does not resolve the mechanism of that behavior. The same is true of volatile and toxic. Why then should tolerant be expected to explain as well as describe?

The controversial discussions of Baker (*2*), Shirley (*3*), and Toumey and Korstian (*5*) have been concerned primarily with the establishment of tolerance as an *explanation* for all forest succession and have no direct bearing on tolerance as a technical descriptive term. The definition of tolerance by the Society of American Forester (*4*) is an attempt to include both the descriptive and explanatory usages, that is, an attempt to specify *of what* as well as to describe behavior. This dualism renders the definition important, for it is inherently misleading, it serves no useful purpose, and it has no precedent in other sciences. At times tolerance has been treated, not only as the description and explanation of tree behavior but as the *cause* of that behavior. In this usage tolerance comes uncomfortably close to being depicted as a specialized Mother Nature, a mystical force in sylvan mythology. Shirley (*3*) has suggested that the terms "shade tolerance," "drought tolerance," etc. be substituted for the unqualified term. At present, general acceptance of his suggestion would rob the term of its major utility. Who knows, for example, whether sugar maple, beech, and western redcedar should be described as "drought tolerant," "shade tolerant," or "*what* tolerant?"

The preoccupation with the explanatory usage of the term has nearly obscured the valuable descriptive usage. However, the confusion need not continue, as can be shown with a few examples of good and poor usage. A statement such as, western redcedar is very tolerant, or ponderosa pine is intolerant, is excellent technical description. A statement such as, western redcedar appears in the climax because it is very tolerant, is misleading. It is comparable to the statement, barium carbonate precipitates because it is insoluble, which really means, "barium carbonate precipitates, *that is*, it is insoluble." A statement such as Baker's (*2*), "Foresters have long sought the cause of tolerance, but with no conspicuous success," which emphasizes tolerance as a single reaction with a single cause, is misleading. Tolerance represents a whole pattern of behavior, with the separate segments not necessarily having common causes and mechanisms. His discussion of "The Basic Causes of Tolerance" becomes much more meaningful when one thinks instead in terms of the causes of differences in successional tendencies, the causes of differences in crown densities, the causes of differences in juvenile growth rate, etc. A statement such as that of Toumey and Korstian (*5*), "The tolerance of a species gives an innate character to its growth and development and to forest types in which it is prominent," which emphasizes tolerance as a causative force, tends to engender semi-mythology.

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First Tropical Land Conference Meets in Ceylon

Largely as the result of persistent demand from the forestry profession, a new and promising step in world resource development was taken last September, when the first FAO-sponsored Land Utilization Conference met in Ceylon. This was the first of three proposed regional conferences, the present meeting covering the tropical areas of Asia, the Far East, and the Pacific Islands, the two to follow embracing tropical Africa and Latin America.

The Ceylon meeting was long overdue. Even before the beginnings of FAO, the Forestry Committee of the Interim Commission on Food and Agricultural had emphasized the need for an early conference where the integrated use of renewable resources might be discussed. Such a conference, it was felt, would influence member governments to establish programs recognizing the interdependence between all the resources of a region, as well as the evils that often follow the development of a single resource without considering its effect upon the others. It was the committee's intention that at such conferences foresters, agriculturists, soil specialists, range experts, and water resource scientists, working as a group, might create unified policies of balanced land use.

Toward such an end, FAO, by its very organizational set-up, possessed one unique advantage: its Divisions of Agriculture and of Forestry functioned under the same roof. These Divisions, working together, could make the land utilization conferences their shared responsibility, and so bring the intimate relationships between forestry and agriculture to the attention of member governments.

That this was not the case at the Ceylon meeting seems to have been a waste of valuable opportunity for achieving an integrated viewpoint in the two major aspects of land use. No signs of collaboration between Forestry and Agriculture were evident, and preparations for the meeting had apparently been made by the Division of Agriculture.

One fortunate circumstance tended to compensate for this deficiency: the fact that the delegations were composed almost wholly of competent technicians and experienced land managers. As a re-

sult of the wide and varied background of these delegates, the conference finally adopted a number of recommendations that, if implemented, should go a long way in achieving integrated resources use.

Two basic principles, particularly, were approved, which may well serve as guide-posts for the two future land utilization conferences, and which governments might advantageously follow when making plans for regional resource development. The first of these principles emphasized the need for a comprehensive resource inventory as the basis for development policies. The second affirmed the necessity for developing the major resources of a region as a whole and with full consideration of the effect that any change in the status of one resource may have upon the others.

The conference pointed out that much lip service has been paid to these principles, but in too many cases regions have been thrown open to development without any exact knowledge of the extent or kind of resources involved, or of the consequences that may follow the imbalance caused by human interference. Had governments generally given consideration to these basic principles in the past, many millions of dollars might have been saved in terms of silted reservoirs, declining water supplies, and the destruction of arable hectares.

Fourteen governments were represented at the conference, and more than seventy-five persons took part in discussions and field trips. Next to the United Kingdom, the United States delegation was the largest. It had been chosen with a view to wide coverage of the important phases of tropical land use, and was composed as follows:

MILTON H. BUTTON, agricultural administrator for the Trust Territories of the Pacific Islands,

RAYMOND H. DAVIS, chief Far East Branch, Food and Agriculture Division, ECA,

H. B. DONALDSON, chief Natural Resources Section, SCAP,

ROBERT L. PENDLETON, foreign agricultural adviser on Agronomy and Soil Science, OFAR,

ROY SIMONSON, assistant chief, Division of Soil Survey, USDA,

TOM GILL, chairman, Committee on International Relations, Society of American Foresters (chairman of delegation).

One circumstance that should bring satisfaction to American foresters is the fact that, recognizing the importance of the role of forests in land use, the chairmanship of the U. S. delegation had been placed in the hands of a forester. This recognition of forestry as a major tool for securing balanced land use was repeatedly stressed by the conference.

Four days were given over to field trips in which the delegates were shown the varied and impressive activities of the Ceylon Government with regard to resettlement, water development, agricultural research, livestock breeding, and other phases of land use. Forestry delegates had an opportunity to examine forest nurseries and a few of the plantations which, in spite of adverse site, showed remarkable survival and a phenomenal growth rate.

The conference was extremely fortunate both in having as its efficient chairman Mr. K. Kanagasundram, land commissioner of Ceylon, and in enjoying the thorough preparations made by the Ceylon officials. It was, however, the feeling of many delegates that the meeting might have proven even more fruitful had FAO prepared an agenda sufficiently far in advance to permit a study of its items by member nations before the meeting. This would have given governments an opportunity to suggest improvements and to select for their delegations specialists competent to discuss the major agenda items. It was also felt that in making plans for the two future land utilization meetings FAO should formulate a program and an agenda that will be the product of the combined efforts of all its divisions having to do with land use, especially the Divisions of Forestry and of Agriculture.

Yet whatever the shortcomings, this first meeting should be a source of satisfaction both to the FAO administrative staff and to member nations, since from it emerged some excellent papers and a statement of fundamental principles of land use applicable to tropical regions. Of particularly timely interest in these days of technical assistance was the emphasis placed by the delegates upon the importance of regional studies made by teams of specialists as opposed to studies of any single resource made by a single technician. FAO, in its own technical assistance programs, has been increasingly applying this principle in the interest of balanced resource development.

TOM GILL, *Chairman,*
Committee on International Relations.

Costs of Producing Mine Props

Costs of producing mine props with different kinds of saws have been tested near Birmingham, Ala., by Robert M. Osborn of the Southern Forest Experiment Station.

For felling and bucking trees 8 inches in diameter and larger, a power chain saw with a three-man crew proved considerably more efficient than two-man crews using crosscut or bow saws. This advantage held true only as long as the power saw was kept in reasonably steady operation.

For trees below 8 inches, a small advantage lay with the handsaw crews, with the bow saw being slightly cheaper than the crosscut.

Tree species cut in the study were chiefly oaks, hickories, and shortleaf, loblolly, and Virginia pines. Costs were recorded for limbing, skidding, and loading and hauling the props to the mine head, as well as for felling and bucking. The costs can be adapted to fence posts, pulpwood, and other products of similar size.

Costs of Producing Mine Props is Occasional Paper 124 of the Southern Forest Experiment Station, 704 Lowich Building, New Orleans 13.

We Present

Paul H. Roberts

Tall in the Saddle

PAUL H. ROBERTS

Paul H. Roberts sits tall in the saddle. Leather-faced and gravelly-voiced, he is a plainsman who roamed West. A big man, looking good in a ten-gallon Stetson, he is not only a six-footer physically, but he also looms large in stature among the men who have served in the U. S. Forest Service. He retired in December 1951, rounding out a career of thirty-seven years on the job.

You get to know Paul best out riding range or perhaps building a smoke and spinning yarns with him around a campfire. You learn his deep modesty, hearing how he feels about the groups of people who have worked with him over his long career. A tireless friend maker and social mixer, he excells at bowling and square dancing, even calling the dances on occasion. Full of dry humor, but at poker a sphinx, he also likes western music and even organized an old-time orchestra in which he plays the harmonica.

From childhood on his parents' ranch in Maxwell, Nebraska, Paul felt and loved the range. Born August 6, 1891, he learned to straddle a horse early and well. Finishing high school at Lincoln, Nebraska and seeing the need for forester-range men, he entered the University of Nebraska to graduate in 1915 with a bachelor of science degree in forestry with range specialization.

Roberts' first job was at Magdalena, New Mexico in 1915, doing range reconnaissance. For two years, under the blue dome of southwestern skies, he rode and studied the vast national forest ranges. By 1916, the forest officers, recognizing a man with timber and livestock know-how, called him in to write a range management plan for the Sitgreaves Forest in Arizona.

In 1918 Paul was in military service at a cavalry officers' training camp in Texas when the war ended. After being mustered out of the Army, he went back to Region III as inspector of grazing. The pretty Miss Edith Oleson of Albuquerque captured his heart and after July 11, 1920 became known as Mrs. Roberts. A son was born in 1923; Rodney is now a consulting engineer in San Francisco.

Paul became supervisor of the Sitgreaves National Forest in July 1922. Until his time the range on the forest had been all dual-use, between cattle and sheep. One of Paul's first major administrative tasks on the forest was to divide the range between the two classes of livestock. While Roberts was supervisor, the Sitgreaves forest also had a large timber sale going, producing the second largest cut one year of any national forest in the country—some 89 million feet.

During the winter of 1928-29 as supervisor, Paul was honored by being asked to make the "lecture circuit" of forestry schools in the East and Middle West. He was the second forest supervisor to be so honored. In 1931 he was transferred to Washington, D. C., to become the first administrative officer for the Branch of Research.

One October day in 1934, the Chief told Paul Roberts that he was going back to the plains, to grow trees on the prairies in North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas. The Great Plains Shelterbelt Project, also known as the Prairie States Forestry Project, was under way. Before it was completed 223 million trees would be planted in 18,599 miles of shelterbelts on 30,000 farms. Up to 10,000 persons were employed during the planting season. Paul was associate director, later director, of the project from the beginning until its transfer to the Soil Conservation Service in 1942.

Probably no project the Forest Service ever undertook evoked such a flood of publicity. Some persons unfortunately viewed the shelterbelt project as a "cure-all." Skepties swung the other way, condemning the whole idea as foolish. Foresters were divided in opinion. In front of the shifting currents of public opinion and flanked by the multitudes of administrative details, the executive job of the project seemed comparable to the trials of Hercules. A tremendous, organized training program

was inaugurated and carried out. It is an unusual commendation to Roberts as an administrator that in the face of all these publicity, technical, and fiscal problems there was never an occurrence which gave rise to a question of the operational integrity of the work. The success of the project has since become a matter of record.

In 1942 war was blazing in the Pacific. Japan had cut off the United States' supply of Heven rubber. The Forest Service was assigned the war emergency project of producing natural rubber in California from the bushy plant, Guayule (*Parthenium argentatum* —Gray). Roberts was assigned to this project at Salinas as associate director in February 1942. The project had only two and a half months before the planting deadline in which to assemble and set up an organization, obtain equipment and supplies, do the necessary installation work, and get 23,000 pounds of Guayule seed into the seed beds. It was the only existing supply of seed and the entire undertaking depended upon its being done right. There could be no mistakes. Paul helped in the difficult job of administration becoming director of the project in July 1944. The project had produced about three million pounds of natural rubber by July 1946 when Paul was transferred to Region I at Missoula, Montana.

If there is anything Roberts hates, it is "chewing bugs." In 1947 he had an opportunity to nail them a telling blow. A serious outbreak of the Douglas-fir tussock moth had occurred in northern Idaho. Paul was made project leader of the airplane spraying job which was to become the largest of its kind ever undertaken in the United States. Many technical and administrative problems were encountered which could not be solved on the basis of previous experience. Also, the many cooperators in the project called for an able, diplomatic administrator. Roberts again proved the confidence of his superiors. In bare statistics, the picture of the job shows 11 planes making 2,120 spray runs, depositing 390,878 gallons of DDT spray on 413,369 acres of forest land. A large crew of spray checkers reported no living caterpillars were found anywhere in the area covered.

"Boring bugs" bother Paul too. He jumped at the chance to slaughter them in Colorado. An extensive blow-down in stands of Engelmann spruce on the White River Plateau in 1939 spawned an epidemic of Engelmann spruce beetles. In April 1950 Roberts was put in charge of the two-million-dollar Colorado Spruce Beetle Control Project. Some 19 billion board feet of spruce and lodgepole timber were threatened, involving a possible loss of millions of dollars. Here the enemy required ground control measures. Individual trees were sprayed by hand pumps with orthodichlorobenzine in a fuel oil base. A thousand men had to be hired for the crews, 334 miles of truck trails had to be punched in, camps set up, over a million gallons of insecticide had to be purchased, and it was an especially difficult item to procure. Through all the perplexing administrative problems Roberts drove with his characteristic, decisive, yet friendly manner. By the middle of October when the job was completed, a record had been broken. It was one of the most economical jobs ever done on an individual tree insect control project. The cost for treating some 784,000 trees averaged out at $2.25 per tree.

Paul's guiding star has always been a fanatic devotion to duty, never side-stepping any job or refusing to go anywhere at any time. Because of his amazing ability to think big, fast, and accurately under terrific pressures, he has been called upon almost to make a career of crisis projects. Recognizing his contribution to forestry, the Department of Agriculture in 1948 cited him in a superior achievement award for his leadership, initiative, resourcefulness, and successful achievement in the above mentioned projects. A remarkable public servant in forestry, the good he has done on the nation's forests and ranges will not quickly fade away. Americans are richer and stronger for his practice in the profession. In retirement at Newport Beach, California, that state is gaining a distinguished citizen. The Forest Service is losing one of its crack trouble shooters, administrators, and all-around-able forester-rangemen.

BEN M. HUEY.

Reviews

The Progress of Forestry: 1945 to 1950.

American Forestry Association Report. 90 pp. The American Forestry Association, Washington 6, D. C. 1951. $3.

The American Forestry Association has twice in five years made a major contribution to a sound understanding of the problems of forestry in the United States. With a fund of $225,000 supplied by private citizens, state and private organizations the association made a Forest Resource Appraisal the findings of which were presented to the American Forest Congress in 1946. Immediately thereafter, the association adopted a program of action which outlined the steps necessary to be taken through the cooperation of all agencies and ownerships so that our forests may permanently meet the multitude of needs for wood, watershed protection, recreation, and the conservation of wildlife essential to a great and still rapidly expanding economy.

The present report is a highly desirable follow-up of its predecessor. It results from the 1949 decision of the directors of the association to study the developments since the close of World War II in the belief that these facts would be helpful to the public, to forestry agencies of all kinds, and to professional foresters. The report abundantly justifies the undertaking. It should be in the hands of every teacher and every student in our forestry schools. It is equally invaluable for every practicing forester and citizen who desires to be informed upon recent progress toward the solution of some of our basic problems. Under ten chapter headings are factual statements of the finanical outlays for forestry, forest surveys, protection, management, planting, research, utilization, taxation, education, recreation, and other subjects.

Each chapter was prepared by an especially qualified subcommittee. Altogether around seventy well-known foresters, conservationists, individuals, and organizations active in public and private service contributed from their knowledge and experience. Lack of space prevents highly desirable and enlightening quotations from summaries of the discussions under each chapter heading. However, the following is a highlight:

"The period covered by the Report stands out as one of impressive expansion in the progress of American forestry. In broad outline, it was an era of unprecedented public and private investments in forestry undertakings, in technological advancement in the protection, management and utilization of forest growth and in industrial acquirement and development of forest lands for long-range timber culture."

But it is rightly noted that progress has not been uniform. While for the first time all the state and private forest lands on the Pacific Coast are under organized protection, there are still 82,000,000 acres elsewhere without such protection. There is also need for much greater efforts to control the inroads and diseases whose drain upon our forests is estimated to be three times that of fire.

By 1949, the annual production of nursery stock had grown to 230,000,000 seedlings and more than 600 tree planting machines were in use. But only a start has been made upon the acreage that should be planted. It is declared that fully satisfactory watershed conditions prevail on only a small portion of the public lands and upon a still smaller fraction of the forest areas in private ownership.

One-fifth of the privately owned forest land of the country is in the 12 states which now have laws providing for cutting standards on private holdings. There has been no federal legislation on this controversial subject.

The presentation in all cases is factual and judicial in tone, backed by supporting historical references and current data. A minor criticism is that while all expense items for forestry in the federal budget 1944-1949 are presented in full detail, there is no corresponding tabulation of receipts from timber sales, grazing, and other uses of the national forests, parks, and public lands which have enriched the national treasury.

Although there is no publication of the fact, this reviewer is firmly of the opinion that one name in small type at the bottom of the committee's foreword deserves greater recognition. Ovid Butler, in his retirement from many years executive directorship of the association, has again rendered a notable service to our country.

ROYAL S. KELLOGG,
Bradenton, Fla.

Statistical Methodology.

Reviews 1941-1950. By Oscar Krisen Buros. 457 pp. John Wiley & Sons, New York. 1951. $7.

This is the third volume in a series of publications prepared by the author.

The present publication lists 342 books and bulletins on statistical methodology from a wide variety of scientific fields. The subjects covered include climatology, curve fitting, forest mensuration and statistics, and general sampling. Only four of the books are on forestry. For each publication title, author, publisher, and price are listed. To make the book more useable there are separate indexes for titles, authors, and subject matter, and a short section on how to use the book.

A total of 842 reviews, or about four per publication are given. Previously published reviews are given for about two thirds of the publications. The author has edited these, leaving out nonessential information. Reviews of books that have been widely reviewed have been omitted. The length of the

reviews vary. Some are very short; however, for an important book such as *The Advanced Theory of Statistics* by Maurice C. Kendall, 24 reviews covering 24 pages are given.

The author is well qualified to write a book of this kind since he was review editor for the *Journal of the American Statistical Association* for about five years. The book would make an excellent addition to an institution or group library. Because of the limited amount of forestry material foresters probably will not find it of much value.

ROY A. CHAPMAN,
U. S. Forest Service.

Arizona Flora.

By Thomas H. Kearney, Robert H. Peebles, and collaborators. 1032 pp. Illus. University of California Press, Berkeley 4, Calif. 1951. $7.50.

Flowering Plants and Ferns of Arizona, by Thomas H. Kearney and Robert H. Peebles, released in 1942 as Miscellaneous Publication of the U. S. Department of Agriculture has been out of print and unavailable for several years. The failure of the Government Printing Office to print enough copies of their worth-while publications has been compensated for in this case by the availability of *Arizona Flora* by the same authors. Although the authors and publishers insist that this volume is a completely new work, this reviewer can see no need for apologizing for the fact that it is clearly an outgrowth of an earlier work that has proven its excellence in use. The changes that have been made are relatively few, and almost all for the better.

Since 1942 the known flora of Arizona has been increased by one family, 32 genera, and 190 species. The additions include not only new records and newly confirmed records but also introduced species that have now become so firmly established that they must be recognized as part of the uncultivated flora. Accordingly, they are of more than academic interest.

The first 26 pages provide a brief but helpful background sketch for the flora. The account of early botanical exploration adds interest, and gives reference to source material that often provides views of the pristine vegetation. This section, as well as those dealing with physiographic plant ecology, and the geographic and taxonomic relationships of the flora are essentially rewrites of a corresponding section in the earlier work. A good description of the physiography, a helpful summary of the climate, a popularized discussion of the geology and soils, and a review of life-forms have been added as new sections.

A section made up of 32 plates with 45 photographic figures portrays the vegetation types and selected individual species. The photographs are excellent but one wonders if they add enough to a work of this kind to justify the extra cost, which must be considerable.

In the main part of the book, some of the keys have been modified and most of the changes have made them more usable. For example, the key for *Astragalus* is based on vegetative characteristics rather than on the character of fruits which are seldom available. The important feature is that the keys generally carry the reader through to identification with little trouble or uncertainty.

The distributional notes have been expanded and revised. Economic notes are mentioned for most of the genera and frequently for species, and include such items as: food value for man, livestock, and game; use for timber, fuel, and erosion control; medicinal and poisonous properties; and use by the Indian population. The notations on forage values are generally well done. The authors seem to have an exaggerated idea of the erosion control functions of many plants since species of *Calliandra*, *Astragalus*, *Eurotia*, and *Gutierrezia* are cited for their soil-holding ability although the last is admitted to have only little value in this regard.

The addition of a rather complete glossary should make the book easier to use and more attractive to the amateur botanist.

The typography, binding, and general quality of the volume leave little to be desired. Southwestern botanists, foresters, and range men owe a debt of gratitude to the authors and the publishers for making this flora available. All serious students of Arizona's vegetation whether they count themselves as professionals or laymen will want the new work even though they have access to the U. S. Department of Agriculture volume.

C. KENNETH PEARSE,
Southwestern Forest and Range Experiment Station.

Tree Clearance for Overhead Lines.

By George D. Blair. 242 pp. Illus. Electrical Publications, Inc., Chicago 11, Ill. 1951. $4.75.

In this, the second edition of *Tree Clearance for Overhead Lines*, George D. Blair has revised his earlier work, making it of increased value to persons responsible for safeguarding overhead lines from tree interference. One of the new topics which he has included is the use of herbicides for clearing the rights-of-way for electric, communication, and signal lines. The development of pneumatic, electric, and gasoline power saws and their applications "to tree trimming" is also described.

Throughout the book, Mr. Blair emphasizes the common sense approach to the solution of the inevitable conflicts that result in maintaining vigorous and beautiful trees adjacent to overhead lines which must provide continuous and dependable service. He has provided over a hundred photographs, drawings, and charts to show how conflicts can be lessened, expenses cut, and both beauty and service rendered through the intelligent application of the information provided in the book.

It is particularly significant that the author fully appreciates the beauty that properly cared for trees add to roadsides and resi-

dential areas even though overhead lines must be located in the same areas. He applies his knowledge of the habits and properties of the various shade tree species to recommend appropriate spacing and trimming practices for each.

Tree Clearance for Overhead Lines (first edition) was included in the check list of forestry items in a working library which was prepared in 1950 by the Society's Committee on Accrediting Schools of Forestry. Even more so than the first edition, the second is a book that will assist foresters to learn the things about shade tree care that the general public believes foresters should know already. For a company wishing to train men in the care of trees adjacent to overhead lines, the book is invaluable.

ROBERT D. HOSTETTER,
Society of American Foresters.

Fire Behavior in the Northern Rocky Mountain Forests.
By J. S. Barrows. 103 pp. Illus. Northern Rocky Mountain Forest and Range Experiment Station. Paper 29, Missoula, Mont. 1951.

This is the second of two recent major publications which summarize almost thirty years of fire research by the Northern Rocky Mountain Forest and Range Experiment Station. The propriety and value of this station paper are well demonstrated by the fact that the first printing already is exhausted. The author has done a splendid job in organizing and presenting the complicated picture of fire behavior.

While intended primarily as a training manual this publication is virtually a text on fire behavior. It will be indispensable to any program of personnel training for fire control, and every individual in fire control work should have available a copy for study and reference. Foresters or other persons dealing with the protection problem must read and study it to be well informed. With its companion paper "Forest Fires in the Northern Rocky Mountains" there now may be said to be available for the first time really adequate text information for collegiate courses in fire prevention and control. Even though data are regional in source the principles should be applicable universally.

In addition to the introduction there are five chapters and an appendix. The chapters are: (1) principles of combustion; (2) weather; (3) topography; (4) fuels; and (5) fire behavior rating. Each of these chapters is well organized, clearly and logically developed and related to fire behavior.

The 53 illustrations by John B. LaCasse cleverly and artistically portray the facts of fire behavior. Reproductions of photographs are exceptionally good.

The need for fire behavior knowledge is brought out and related to problems of suppression and safety. How a fire will react to influencing factors must determine the speed, strength, and type of attack. Ability to measure and predict fire behavior may anticipate the unexpected and prevent the potential blowup. Safety in fire suppression can be achieved if firefighters have a general knowledge and if the leaders have a high degree of knowledge of fire behavior. Knowing the fundamentals of ignition, combustion, and rate of spread of fires burning in forest fuels should provide the basic "know how."

An interesting formula is provided for use in judging fire behavior. Essentially a basic knowledge of combustion is related to conditions of fuels, weather, and topography. By the use of aids and guides an estimate of the situation can be determined and this leads to the decision for action—when, where, and how to control fire and the safety measures which may be appropriate.

This publication reflects the work of many people and varied researchers. It is fortunate indeed that so much information can be assembled and presented between two covers. It is a milestone in the field of fire control writings.

MERRILL E. DETERS,
University of Idaho.

A Laboratory Manual in Farm Forestry.
By Donald P. Duncan. 70 pp. Burgess Publishing Company, Minneapolis, Minn. 1951. $2.

In the foreword the author states that the original manual, written specifically for Minnesota, has been revised and expanded to apply to the Upper Midwestern Region, including the Central States. This reviewer believes that the manual would be somewhat more useful in the Central States, and possibly elsewhere, if it included a subject matter section on log grades, another on the marketing of forest products, and a third on reforestation. It would also be more helpful to teachers in the Central States if a few of the more southerly species, such as sweet gum, were added to the lists under tree and shrub identification and wood identification. This might be accomplished by reducing the amount of space devoted to measurement, which now occupies one third of the manual.

The first 15 pages of the manual contain generic and specific keys to the identification of 51 native and introduced trees and shrubs, including both summer and winter keys to the broadleaved species. The keys are followed by a glossary of the botanical terms which have been used.

The next 25 pages are devoted to measurement, including cruiser and scale stick construction, and a rather complete treatment of timber cruising and log scaling. This part of the manual also contains a short section on the selection of trees for cutting.

The next part of the manual devotes five pages to the home use of wood grown on the farm. This is followed by three pages on the preparation of management plans.

Windbreak planting is given thorough treatment in the succeeding seven pages, but the reforestation of nonagricultural land attached to farms is given little attention.

The material on wood identification, which occupies the next seven pages, includes a key to 23 native and introduced species, together

with a glossary of the botanical terms used in the key.

The last seven pages are devoted to teaching aids in the form of questions and problems.

A list of references follows each major division of the subject matter. These lists contain a number of forestry texts, including three on farm forestry written by Guise, Preston, and Westveld, and numerous state and federal publications.

It is apparent that considerable thought has been given to the exercises contained in the manual. They are well selected and well developed.

T. E. SHAW,
Purdue University.

The National Parks: What They Mean to You and Me.
By Freeman Tilden. 417 pp. Illus. Alfred A. Knopf, Inc., New York. 1951. $5.

No author in recent years has written so much in one volume extolling the policies of the National Park Service and management of the national park system as has Freeman Tilden in *The National Parks: What They Mean to You and Me*. He admits great admiration for the Service and when critical of it is wont to "turn his back," so to speak.

Here is an admirable interpretation of our great heritages in the national park system. At Crater Lake, a blind man aided by the naturalist "sees" the blue of the lake with its Wizard Island and the sheer walls of the crater's sides. In Shenandoah the old mountaineer Hezikiah Lam, whose land was purchased for park purposes, says, "I allus said these hills would be the heart of the world." No single park or monument is portrayed as the greatest or best. The Grand Canyon, the waterfalls and cliffs of Yosemite, the geysers and hot springs of Yellowstone, each has its own beauty and story to tell.

Foresters, as such, will profit by reading the short introduction "Spirits of the Trees" in the chapter on Green Sanctuaries. A spiritual and moral uplift is obtained here without visiting the forests, but one is deeply moved to visit them.

Again and again throughout the book, conversation and the preservation of all living things and of the inert but inspiring scenic beauty of the parks and monuments are cited and exemplified. Community life in a primeval wilderness is adroitly pictured. The mountain lion is not viewed as a predator or as a trophy on the den wall, but as necessary in his natural habitat and not to be separated from it. Trees are not seen as stacks of lumber or so many houses; grasses not as pounds of meat, and water not as kilowatts, but all of these are seen as being of great utility for enjoyment, for recreation, without consumption, and thus for perpetuity. Interference in natural processes by man is viewed as an evil and only considered imperative when it seems unavoidable to prevent a greater evil from occurring.

The chapter on "Bears, Parks and People" is more than just that. The typical incidents of feeding bears contrary to the rules, and subsequent injuries to visitors, are recounted in a manner which should discourage foolish familiarity. Bears are no problem, nor are the visitors, but the two together can become a problem. Mr. Tilden concludes that an otherwise more or less law-abiding public feels that the prohibitions against feeding the bears, as well as other necessary rules, are an unreasonable intrusion on its rights. He suggests that "visitors police themselves to the greatest extent and regard themselves as trustees of the jewels." The rules—and they are remarkably few—are for the twin purposes of protecting the parks and safeguarding the visitors.

The bear-feeding problem is used as an example of the common lack of understanding of the essence of the national parks. As Mr. Tilden states it, the parks "are the doors that lead into the world of unspoiled nature," and their purpose is to insure that what is now seen may be seen, as nearly as possible, in an unspoiled condition by future generations. The visitor must comprehend the purposes for which the parks were created if he is to derive maximum enjoyment and stimulation from them.

The distinctions in the concept of the national parks and the national forests are clearly made. This is done without the defensive attitude adopted by many writers who are sincere and staunch conservationists. Mr. Tilden is careful to make clear that his espousal of the principles which dictate the management of the parks does not at all conflict with his recognition of the validity of the principles which govern the administration of other public lands for other worthy purposes. This attitude is shared by the most ardent admirers of the national park system. Those who may have occasion to deal with controversial wildland uses will do well to use the direct and objective approach exemplified in Mr. Tilden's writing.

The work is an excellent guide to those who expect to visit the national parks and monuments, and a source of information to the student who desires factual data on individual areas. There are 36 excellent photographs in black and white. The glossary contains popular definitions of geological terms and lists of words of native or other origin occurring in the text. The historian will find in the text an account of the events leading up to the exploration and establishment of Yellowstone and in the appendix a brief history and description of the National Park Service and the national park system.

The Appendix also includes tabular information on locations, areas, how to reach them, history, features, accommodations, special notes and interpretive activities on 54 national parks and monuments in the national park system. Too bad for this purpose, that they are not all there!

S. T. CARLSON,
Santa Fe, N. Mex.

American Woods.

By Shelley E. Schoonover. 266 pp. Illus. Watling & Co., Santa Monica, Calif. 1951. $7.50.

American Woods is of particular interest to the home craftsman and wood hobbyist. The book, in the words of the author, is written from a nontechnical point of view. It presents characteristics, natural ranges, properties, uses, workability, color, and figure for a selected list of approximately 150 species of wood grown in the United States. The list includes the common commercially available woods as well as a great many species which are, commercially speaking, relatively unimportant.

In addition to the species list there is included a discussion of the hobby of woodworking, a brief explanation of the background and reasoning behind the use of common and scientific names for trees, a list of state trees, and a list of dealers in wood for the home craftsman. The elementary anatomy of a tree is discussed and illustrated. Methods of cutting logs into lumber or veneers are described. An elementary discussion of the seasoning of wood is presented. The author has a section on grain and figure in wood illustrated by 24 full color plates. These plates are fine illustrations except for the unnatural appearance of the colors. Black and white plates of 48 wood specimens are also shown. Twenty plates of representative trees are included.

Information is presented for the wood hobbyist or woodworker on such species as Sierra juniper, California nutmeg, Pacific yew, English walnut, pawpaw, downy serviceberry, Texas ebony, honey mesquite, mimosa, staghorn sumac, manzanita, Russian olive, and many others. The book is particularly valuable for its presentation of information on these minor species. Using pawpaw as a typical example, in addition to information on the physical appearance of the tree, its common names, and its range, the following information is given:

"The Wood: The wood of the pawpaw is soft, coarse-grained and spongy, not strong, but has a beautiful greenish-yellow to yellowish-brown color. The medullary rays are prominent and when quarter-sawed the wood is extremely attractive. It is similar in texture to the sumac, but somewhat firmer. It may be worked easily with all types of tools, which must be sharp because of the soft texture of the wood. It is too soft to be easily stained, but in its natural color may be dressed down smooth with a satin finish.

"Uses: The pawpaw wood has no commercial use except for fuel. However, this wood is recommended to the wood craftsman. It is well adapted for turned novelties and for all types of build-up designs not requiring large pieces inasmuch as the tree is usually small."

Physically the book is a quality job as to printing, paper, and illustrations which accounts for the relatively high price.

American Wood is fine for the wood enthusiast. It is perhaps elementary in most respects for the "log-run" forester or technologist having no specialized interest in noncommercial woods.

ROBERT BLUMENSTEIN.

Dictionary for the Wood and Timber Trade. English and German.

By Henry Mrugowski. 201 pp. M. & H. Schaper, Hanover, Germany. 1948.

This is a 4 x 5½ inch book, on a heavy pulp stock in board cover. It covers timber trade and forestry terms. The author states that he tried to include provincial terms and localisms in German and English and that he tried "to find the real corresponding sense of these words."

Included in the dictionary is a list of the more common woods with scientific names and the common names in English and German. This list appears in both parts. Part I is English-German, and Part II is German-English.

Finding a word should be easy particularly because the word itself is in a separate column and its translation in a column to its right; and because the type is plain and German compound words are given in full.

This dictionary is a useful supplement to the German-English dictionaries already available.

EMANUEL FRITZ,
University of California.

Ecological Animal Geography.

By W. C. Allee and Karl P. Schmidt. 2nd Ed. 715 pp. Illus. John Wiley & Sons, Inc., New York. 1951. $9.50.

Ecological workers, including managers of wild lands, continually face the problem of whether to concentrate studies and efforts on small areas, with detailed results, or on large areas, with general results. Allee and Schmidt have chosen the latter, and have accomplished the monumental task of dealing with the whole world, even the remotest regions. Workers in all parts of the world are quoted to support and illustrate principles they set forth. They have dealt with all the animal kingdom, from the lowly protozoan up to man.

This work is based on *Tiergeographie auf oekologischer Grundlage*, by the late Richard Hesse, University of Berlin, published in 1924. Allee and Schmidt revised this basic work, in collaboration with Hesse, and published the first edition of *Ecological Animal Geography* in 1937. This second edition has been drastically revised and many new ideas have been included. There is a much amplified terminology and a discussion of the background for world-wide conservation. The chapter bibliographies are greatly expanded in this edition.

The authors intend only to cover zoogeography, not biogeography; they accomplish this purpose. Most of the discussions deal with the effect of the physical factors of the environment (light, temperature, precipitation, humidity, wind) on the animal. The authors are particularly interested in animal distribution and adaptation produced

by these factors. Homogeneity, heterogeneity, and endemic forms are explained in the light of the physical factors.

However, in two important ways, Allee and Schmidt are forced to consider the effect of vegetation upon animal geography. One is when discussing productivity, which necessarily involves vegetation as the basic part of the food chain; the other is in the classification of habitats, which often must be based on and named by the type of vegetation. This is especially true of the land animals, which are classified as related to forest, grassland, etc. Also it is necessary to describe the effects of the forest, for instance, on the environment, and therefore on the animal.

Approximately one-third of the book is concerned with the distribution of marine animals and those in inland waters, one-third is concerned with the distribution of land animals, and the balance is occupied with a general introductory section on the ecological foundations of zoogeography. Foresters will find particular interest in the following chapters:

Part I, The Ecological Foundations of Zoogeography: Chapter 8, The Influence of Extent of Range; and Chapter 9, Biotopes and Biocoenoses.

Part IV, The Distribution of Land Animals: Chapter 21, Forest Communities; Chapter 22, Grassland and Desert Communities; Chapter 24, Alpine Animals; and Chapter 28, The Effect of Man on the Distribution of Other Animals.

The fact that many uncommon ecological terms are used but not defined is an indication that this is an advanced work. On the other hand, the authors devise and define a new series of terms to describe some ecological associations and principles. This is reminiscent of the enthusiasm of Weaver and Clements' *Plant Ecology*, but not quite of their degree. Specific information is provided on the meaning, implications, and support of such ecological "laws" as the Bergmann rule, Allen's rule, and Rensch's rule.

Because the coverage of the book is so broad, Allee and Schmidt have been forced into broad generalities in covering certain phases. This may leave the accuracy of the specific application of their principles open to question by those who are acquainted with greater detail.

A few of the many statements which foresters may want to ponder are:

"Pure water is harmful to organisms." (p. 16.)

". . . we define a forest as an aggregation of trees at least 8 m. in height. . ." (p. 508.)

"Martens, wildcats, and lynxes are typical of temperate deciduous forest." (p. 524.)

"In the main the fur supply is decreasing, although closed seasons and *protection of females and young* (italics mine) are preventing extermination." (p. 529.)

Allee and Schmidt have done a service to science by collating and interpreting man's knowledge of ecological animal geography, but have produced little of immediate practical value because of great generality and specific inaccuracies. Altogether, this book is of greatest value to the forester in broadening his horizon, or as a source of reference for zoo-ecological principles, terms, and knowledge; but not as an everyday guide closely related to his field.

HAROLD W. STEINHOFF,
Colorado A & M College.

Union Bay: The Life of a City Marsh.

By Harry W. Higman and Earl J. Larrison. 315 pp. Illus. University of Washington Press, Seattle. 1951. $4.

This, like their first book, *Pilchuck: The Life of a Mountain*, deals with a localized area. But, like *Pilchuck*, it should be of interest to students of natural history anywhere for the principles of bird-mammal-plant relationships portrayed in the various chapters apply in similar areas elsewhere. The unique feature in this instance, however, is the fact that the Union Bay marsh, bordering the University of Washington campus and the busy Lake Washington ship canal, is surrounded by and subjected to the influence of a large city.

The story is built about the experiences of a biology teacher who makes periodic visits to the marsh in search of interests in his chosen field. A secondary character is the manager of the canoe house who, although he figures but casually in the action, aids in relieving what might otherwise resolve itself in a typical textbook treatment of the material.

The authors carry the reader through the seasons of the year and by means of personalized episodes and observations portray the various changes that occur in plant and animal relationships during that period, as well as the manner in which these have adjusted to the impact of a metropolitan environment.

Throughout the book there is maintained a friendly touch such as might exist between people with a common interest in natural history who, in addition to being aware of the technical aspects, are not unmindful of the values of unexpected observations — rarely found in textbooks — that are unfolded to those who carry such activities into the field for first-hand observation.

C. FRANK BROCKMAN,
Seattle, Wash.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, The New York State College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

The Forest Situation in the Province of Quebec. By J. D. Gilmour. 14 pp. Univ. of British Columbia, Vancouver. 1951. The H. R. Macmillan Lectureship in Forestry, 1951 (2).

A Forestry Education Program for the Ryukyu Islands. By E. V. Zumwalt. 21 pp. U. S. Civil Administration of the Ryukyu Islands. Office of the Deputy Governor, Food & Natural Resources. APO 719. 1951. Mimeog.

North with the Spring: A Naturalist's Record of a 17,000 Mile Journey with the North American Spring. By E. W. Teale. 366 pp. Illus. Dodd, Mead & Co., New York. 1951. $5.

Our National Forests. By U. S. Forest Service. 34 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. Agric. Info. Bul. No. 49. 1951. 20 cents (Govt. Print. Off.).

The Progress of Forestry, 1945-1950. 100 pp. American Forestry Assoc., Washington 6, D. C. 1951. $3.

State Publications on Tree Identification (U. S. and adjacent Canada) Comp. by W. M. Harlow. 10 pp. State Univ. of New York. College of Forestry, Syracuse. 1951. Mimeog.

Conservation

The Muskingum Story. 12 pp. Illus. American Forestry Assoc., Washington 6, D. C. 1951.

Some Social Aspects of Forest Conservation. By C. E. Lively. 8 pp. Missouri Agric. Expt. Sta., Columbia. Cir. No. 359. 1951.

Forest Management

The Use of Chemicals to Control Inferior Trees in the Management of Loblolly Pine. By L. E. Chaiken. 34 pp. Southeastern Forest Expt. Sta., Asheville, N. C. Sta. Paper 10. 1951. Processed.

Forest Products

Crops in Peace and War; The Yearbook of Agriculture 1950-1951. (Crops from the Forest, p. 791-890) 942 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1951. $2.50. (Govt. Print. Off.).

Employment in Louisiana's Forest Products Industries . . . 1938-1950. 7 pp. Louisiana State Dept. of Labor, Baton Rouge. 1951. Mimeog.

Ohio Maple Syrup . . . Some Factors Influencing Production. By H. R. Moore, W. R. Anderson, and R. H. Baker. 53 pp. Illus. Ohio Agric. Expt. Sta., Wooster. Research Bul. No. 718. 1951.

Special Report on Louisiana's Forest Products Industries. 11 pp. Tables. Louisiana State Dept. of Labor, Baton Rouge. 1950. Mimeog.

Land Use

Strip-Mined Lands of the Western Interior Coal Province. By N. F. Rogers. 55 pp. Illus. A Contr. of Central States Forest Expt. Sta., Missouri Agric. Expt. Sta., Columbia. Research Bul. No. 475. 1951.

Logging and Milling

Factors Influencing the Manufacture of Sawlogs into Lumber in Eastern Canada. By G. E. Bell. 35 pp. Illus. Canada Dept. of Research & Development, Forestry Branch, Ottawa. Bul. No. 99. 1951.

The Prince Timber Ready Reckoner, a new ed. rev. & augmented by R. L. B. Sim. Ernest Benn, Ltd., 154 Fleet St., London E.C. 4. 1951. 78.6d.

Rules for the Measurement and Inspection of Hardwood Lumber, Cypress, Veneers and Thin Lumber. 80 pp. Illus. National Hardwood Lumber Assoc.: Chicago. 1951.

Sawdust as Fuel in Eastern Canada. 9 pp. Illus. Canada Dept. of Research & Development, Forestry Branch, Ottawa. Bul. No. 101. 1951.

Protection

Forest Fire Damage Appraisal Procedures and Tables for the Northeast. By A. W. Lindenmuth, Jr., J. J. Keetch and R. M. Nelson. 28 pp. Southeastern Forest Expt. Sta., Asheville, N. C. Station Paper No. 11. 1951. Processed.

The Western Pine Beetle; A Serious Enemy of Ponderosa Pine. By J. M. Whiteside. 10 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. Cir. No. 864. 1951.

Range Management

The Dalles Pocket Gopher and Its Influence on Forage Production of Oregon Mountain Meadows. By A. W. Moore and E. H. Reid. 36 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. Cir. No. 884. August 1951. 15 cents. (Govt. Print. Off.)

Grasses of Southwestern United States. By F. W. Gould. 343 pp. Maps. Univ. of Arizona, Tucson. Biological Sci. Bul. No. 7. 1951.

Important Grasses on Montana Ranges. By H. E. Morris and others. 52 pp. Illus. Montana Agric. Expt. Sta., Bozeman. Bul. No. 470. December 1950.

Indicators of Condition and Trend on High Range-Watersheds of the Intermountain Region. By L. Ellison and others. 66 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. Agric. Handbook No. 19. August 1951. 30 cents. (Govt. Print. Off.)

A Method for Measuring Trend in Range Condition on National Forest Ranges. By K. W. Parker. 26 pp. Illus. U. S. Forest Serv., Div. of Range Research. Washington 25, D. C. October 17, 1951. Mimeog.

Pellet Reseeding Trials on Southern Idaho Range Lands. By E. W. Tisdale and K. B. Platt. 23 pp. Illus. Idaho Univ., Forest Wildlife & Range Expt. Sta., Moscow. Special Research Rpt. Proj. 16. January 1, 1951.

Steers Gain on Forest Range in South Mississippi. By R. S. Campbell and others. 2 pp. Illus. Mississippi Agric. Expt. Sta., State College. Inform. Sheet No. 463. April 1951.

Recreation

Among the Wisconsin State Parks and Forests. 52 pp. Illus. Wisconsin Conservation Dept., State Capitol, Madison. Pub. No. 400.

Meals and Nights in the Open. By J. A. Cope and F. E. Winch, Jr. 54 pp. State Univ. of New York College of Agric., Ithaca. rev. 1951. Mimeog.

Silviculture

Commercial Sources of Forest Tree Seed and Seedlings. 8 pp. U. S. Forest Serv., Washington 25, D. C. 1951. Mimeog.

Fall Planting Studies with Pine in Southern Illinois. By W. R. Boggess. 6 pp. Illinois Agric. Expt. Sta., Urbana. Forestry Note No. 25. 1951. Mimeog.

Forest Plantations in Arkansas; Plantations in the Arkansas Ozarks and Experimental Plantings on a Coastal Plain Site in Southwest Arkansas. By F. M. Meade. 50 pp. Illus. Arkansas Agric. Expt. Sta., Fayetteville. Bul. No. 512. 1951.

Prescribed Burning in South Jersey Woodlands. By Silas Little. 4 pp. Illus. Rutgers Univ., New Brunswick, N. J., Leaflet No. 65. 1951.

A Technique for Hand Planting of Forest Trees in the Southern Appalachians. By W. G. Wahlenberg. 12 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. Station Paper No. 12. 1951. Processed.

Wildlife Management

This Fascinating Animal World. By Alan Devoe. 303 pp. Illus. McGraw-Hill Book Co., New York. 1951. $3.75.

Wonders of Wildlife Photography. 96 pp. Illus. British Book Serv., Toronto. 1950.

Wood Technology and Utilization

Canadian Woods and Their Properties and Uses, 2d ed. 367 pp. Illus. Canada Minister of Research & Development, Forestry Branch, Ottawa. 1951. $3.

A Review of Electrical Properties of Wood. By J. M. Yavorsky. 27 pp. Illus. State Univ. of New York College of Forestry, Syracuse. Technical Pub. No. 73. 1951. 30 cents.

Timber Leaflets (on tropical timbers . . . pub. . . . as they become available). By Great Britain Dept. of Science & Industrial Research. Forest Products Research Laboratory, London. 1951.

Society Affairs

Compiled by ROBERT D. HOSTETTER, *Assistant Executive Secretary*

George Drake, E. L. Demmon Elected SAF President, Vice President

Three-Fifths of Voters Cast Ballots

GEORGE L. DRAKE was elected on December 1, 1951 to serve as president of the Society of American Foresters during 1952 and 1953. A member of the Puget Sound Section, Mr. Drake is vice president of the Simpson Logging Company, Shelton, Wash. He was employed by that firm in 1930 as general superintendent in charge of all forestry operations. For eighteen years prior he was employed by the U. S. Forest Service in Washington, Oregon, and Alaska.

Elwood L. Demmon of the Appalachian Section was elected vice president for the next biennium. Since May 1951 he has been director of the Southeastern Forest and Range Experiment Station, Asheville, N. C. Mr. Demmon entered the U. S. Forest Service in 1925, following seven years as forester for a rubber company in Sumatra, and was director of the Southern Forest and Range Experiment Station and the Lake States Forest Experiment Station prior to his transfer last year.

GEORGE L. DRAKE
President

Sixty-three percent of the Society's 7,370 eligible voters cast ballots. Although the total membership of the Society was 8,250 on November 30, 1951, the 930 persons in the Student, Affiliate, Associate, Corresponding, and Honorary grades were not eligible to vote. In the 1949 election 58 percent of the eligible voters cast ballots.

In addition to the officers, the nine other Council members listed below were elected by the Hare system of proportional representation for the 1952-1953 term.

William J. Brown, assistant chief forester, Kimberly-Clark Corporation, Neenah, Wis. (Wisconsin-Upper Michigan Section.)

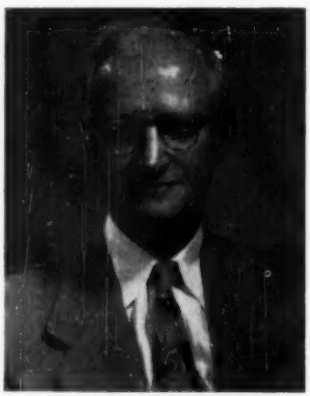
Dwight B. Demeritt, manager of woodlands, Dead River Company, Bangor, Maine. (New England Section.)

Frank H. Kaufert, director, School of Forestry, University of Minnesota, St. Paul, Minn. (Upper Mississippi Valley Section.)

C. Otto Lindh, regional forester, U. S. Forest Service, Albuquerque, New Mex. (Southwestern Section.)

Gordon D. Marckworth, dean, College of Forestry, University of Washington, Seattle, Wash. (Puget Sound Section.)

Richard E. McArdle, assistant chief, U. S. Forest Service, Washington, D. C. (Washington Section.)



ELWOOD L. DEMMON
Vice President

Earl Porter, manager, Woodlands Department, southern Kraft Division, International Paper Company, Mobile, Ala. (Southeastern Section.)

Perry A. Thompson, former regional forester, U. S. Forest Service (retired), San Rafael, Calif. (Northern California Section.)

Ruthford H. Westveld, professor of forestry and chairman, Department of Forestry, University of Missouri, Columbia, Mo. (Ozark Section.)

Messrs. Brown, Thompson, and Westveld are serving their first terms on the Council. The six other members were reelected.

Bernard Frank was chairman of the Committee of Tellers which conducted the election. Assisting him were the following Society members: Frances J. Flick, Colleen McCarthy, John W. East, Henry H. George, James P. McWilliams, George K. Stephenson, Seth Jackson, Dwight B. H. Smith, Jr., Edward Furlow, J. Hugo Kraemer, and John J. Zirkle.

Determining the successful candidates required six hours. Five candidates for president and 20 for Council members had been nominated.

The Council meets twice each year, usually in June and at the time of the annual meeting of the Society.

WILLIAM J. BROWN

DWIGHT B. DEMERITT

FRANK H. KAUFERT

C. OTTO LINDH

GORDON D. MARCKWORTH

RICHARD E. MCARDLE

EARL PORTER

PERRY A. THOMPSON

RUTHFORD H. WESTVELD

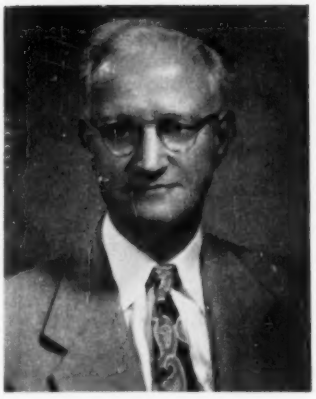
Board Elects Eleven Fellows

ELEVEN of the 34 nominees were advanced to the grade of Fellow of the Society of American Foresters on December 1, 1951. Their photographs appear on this and the next page. Election as a Fellow is the Society's highest membership distinction.

Fellows are foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character. They must be Members at the time of advancement.

Sixty-one out of a possible 63 ballots were cast by members of the Fellow electoral board. The board for this election was composed of the 54 Fellows and nine other Council members. Electors vote for all nominees they wish to see elected. To be elected a nominee must receive not less than one-half of the votes cast, or in this case 31. Frances J. Flick and George R. Phillips served as tellers in the current election of Fellows.

Eleven of the 31 candidates for advancement to the grade of Fellow in 1949 were elected.



ELWOOD L. DEMMON

Candidates are nominated by the petition of 25 Members of the Society. The 11 Fellows elected on December 1, bringing the total to 65, are listed below:

Hugh Curran, Forestry Division, Ministry of Agriculture, Caracas, Venezuela.

Walter J. Damtoft, assistant secretary-treasurer and director of general wood and woodlands department, Champion Paper and Fibre Company, Canton, N. C.

Elwood L. Demmon, director, Southeastern Forest and Range Experiment Station, Asheville, N. C.

Emanuel Fritz, professor of forestry, School of Forestry, University of California, Berkeley, Calif.

Cedric H. Guise, professor of forestry, Department of Conservation, Cornell University, Ithaca, N. Y.

B. Frank Heintzleman, regional forester, Alaska Region, U. S. Forest Service, Juneau, Alaska.

George M. Hunt, former director of the Forest Products Laboratory, Madison, Wis.

Myron E. Krueger, professor of forestry, School of Forestry, University of California, Berkeley, Calif.

Fred W. Morrell, 707 Beverly Drive, Alexandria, Va.

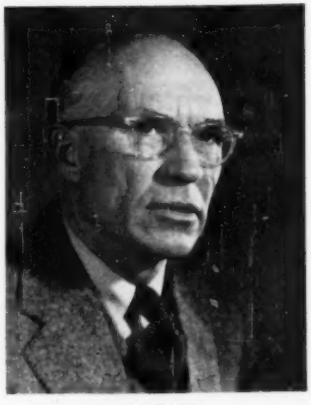
Jay H. Price, regional forester, U. S. Forest Service, Milwaukee, Wis.

Hardy L. Shirley, assistant dean, College of Forestry, State University of New York, Syracuse, N. Y.

HUGH CURRAN

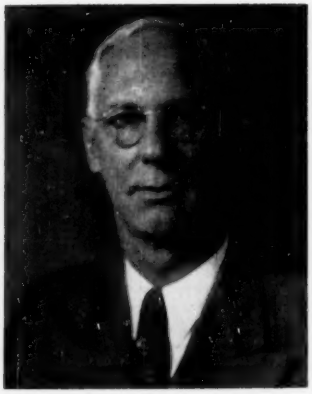
EMANUEL FRITZ

WALTER J. DAMTOFT



CEDRIC H. GUISE

B. FRANK HEINTZLEMAN



FRED W. MORRELL

GEORGE M. HUNT

JAY H. PRICE

Barry Evans Photo

MYRON E. KRUEGER

HARDY L. SHIRLEY

SAF Achieves Greatest Membership Increase

A net increase of 1,443 members during fiscal year 1951 marks the most rapid growth the Society of American Foresters has ever achieved. Total membership on November 30, 1951, end of the Society's fiscal year, was 8,481 as compared to 7,038 twelve months previously.

Robert D. Hostetter, who has coordinated the Society's membership activities during the past two years, attributes the record increase to the splendid work performed by Section membership committees and Section representatives at forestry schools in acquainting eligible nonmembers with the Society's aims, policies, and programs.

During 1951, a total of 1,126 Junior Members was elected, while during 1950, a total of 1,022 Junior Members was elected.

Membership fluctuations since 1940 are tabulated below:

Year	Total	Increase
1940	4,708	149
1941	4,711	3
1942	4,534	—177
1943	4,544	—190
1944	4,342	— 2
1945	4,382	40
1946	5,065	683
1947	5,690	625
1948	6,241	551
1949	6,628	387
1950	7,038	410[1]
1951	8,481	1,443

[1]As a result of a Constitutional change requiring that members whose dues are delinquent must be dropped from membership on November 30 instead of December 31 as had been done previously, such persons for both 1949 and 1950 were terminated during fiscal year 1950. Otherwise, the net increase for 1950 would have been 660.

In 1936, the increase in membership was 834, but in no other year prior to 1946 did the net increase exceed 600. The 1951 net gain of 1,443 represents an increase of 21 percent over the total at the beginning of the year.

As shown in the accompanying graph, 426 members resigned, died, or were dropped for nonpayment of dues during 1951, while 150 former members were reinstated. The names of persons whose membership was terminated during 1951 will be published in the February JOURNAL.

Net increases for 1951, by grade of membership, are tabulated below:

Grade	Dec. 1, 1950	Nov. 30, 1951	Increase
Student	0	552	552
Junior	3,315	3,864	549
Member	3,195	3,469	274
Fellow	57	54	—3
Affiliate	209	268	59
Associate	198	206	8
Corresponding	52	55	3
Honorary	12	13	1
Totals	7,038	8,481	1,443

Endorsing Applicants Simple as A B C

Nearly every member of the Society has been or will be asked to endorse an applicant for admission or advancement in the Society. The procedure to be followed is as simple as ABC.

There are three *types* of endorsements which ordinarily concern Section members:

Type A. Endorsements of applicants for original election to the Affiliate or Associate grades; for advancement from the Affiliate grade to the Junior grade; or for advancement from the Junior grade to the Member grade.

Type B. Endorsement of applicants for "automatic" advancement to the Member grade.

Type C. Endorsement of applicants for the Junior grade, Class A, who were not Student Members.

In Type A, each of three voting members fully complete an endorsement form in behalf of the applicant. That is all that the endorsers are required to do. They do not sign the *application* form; in fact, they need not even *see* the application form. The Section membership committee studies the three endorsement forms and the application and if approval is justified, the committee so indicates in item seven of the application form.

In Type B, no endorsement forms are required. The Section membership committee takes appropriate action based on the application only, and indicates its action in item seven of the application form.

In Type C, the Section takes no action at all. Any three voting members who are acquainted with the applicant indicate their approval by signing their names in item seven of the application form.

In *no* case does anyone except the applicant himself make any entries in items one to six, inclusive. Item seven is reserved for approval by Section officials only, in Types A & B. In Type C, it is reserved for the signature endorsement of three individual voting members.

The endorsement of an applicant for the Student Member grade is the same as in Type C, except that the endorsers must be members of the student's faculty.

The applications of former members seeking reinstatement do not require endorsement of any kind.

The procedure for endorsing applicants is simple, as simple as ABC!

Membership forms are available from all Section membership chairmen and from the Society of American Foresters, Mills Building, Washington 6, D. C.

Professional Reports Constitute K-T Meeting

Seventy members of the Kentucky-Tennessee Section convened in Knoxville, Tenn., November 16 and 17, 1951. The first day of the regular annual winter meeting was devoted to technical papers, and the second half day to Section business. These new officers were installed: Harry Nadler, chairman, Box 31, Pineville, Ky.; Henry Sipe, vice chairman, Cumberland National Forest, Winchester, Ky.; John W. Lehman, secretary-treasurer, P. O. Box 88, Norris, Tenn.; Maxwell MacMaster, retiring chairman, automatically became the fourth member of the executive committee. Henry Sipe will also serve as the Section's membership chairman.

Harry Nadler, *left*, was advanced to chairman of the Kentucky-Tennessee Section on November 17, 1951. John W. Lehman, *right*, was elected secretary-treasurer, succeeding Henry Sipe who was advanced to the office of vice chairman.

William C. Ackerman, TVA hydraulic engineer, reported on the effect of 15 years of cover improvement on the hydrologic characteristics of 1700-acre White Hollow watershed in eastern Tennessee. There has been little seasonal change in runoff, he said; however, peak discharges from summer storms are now 8 to 27 percent less than they were 15 years ago. The time required for equal volumes of summer runoff to discharge from the watershed has been increased by as much as 500 percent. There has been no apparent change in total water yield; much better watershed protection has been realized without reducing total runoff. Mr. Ackerman reported a greatly reduced silt load in the stream.

Al Hyder, federal aid coordinator, discussed game and timber management on the Gatoosa Wildlife Management Area in Tennessee.

A formula for rating circular sawmills was presented by W. N. Darwin, TVA forester. Based on a study of 58 circular mills in the Tennessee Valley, this rating system enables mill operators to spot weaknesses in their practices and thus increase production and profits.

Louis A. Krumholz discussed the results of an ecological survey of White Oak Creek, conducted jointly by the TVA Forestry Division and the Atomic Energy Commission, Oak Ridge. The study so far has shown no harmful effects from radioactive waste on plants and animals in the area.

New discoveries of oak wilt in the Southern Appalachians were reported by George H. Hepting, USDA Division of Forest Pathology. Surveys this summer uncovered the disease in Buncombe and Haywood counties, North Carolina; Greenup County, Kentucky; Augusta County, Virginia; and Cocke, Greene, Sullivan, Washington, Hamblen, and Jefferson counties, Tennessee. He intimated that researchers may be on the verge of a major discovery concerning the disease, a discovery that would permit relatively simple and effective control measures.

The banquet speaker was Lou Williams, president of the Keep Tennessee Green Association. He tried to assess the forester's job as he views it from the non-professional angle. And he offered this advice:

"My business career has been devoted to selling. I believe your job lies as much in this field as it does in the technicalities of your profession. If I were a forester—and I really wish I were—and I wanted to approach a prospective client who owned some woodland in need of management, I'd never approach him in a timid apologetic attitude. I would consider that my services would mean more in dollars and cents to him than they would to me. I would decide that this man needed me and my services more than I needed him. I would exude confidence in the knowledge that I had something very worthwhile and profitable to offer him. Experts in the selling field say that no sale is a good one unless all parties to it profit. You are in a profession where both parties usually profit. I believe this approach, accompanied by a complete knowledge of the plan you wish to propose, will go a long way toward helping you solve the problem of how to reach the owner of the small woodlot."

Vestal Lumber Company, Knoxville, and Nickey Brothers, Inc., Memphis, were joint hosts at a social hour preceding the banquet. Door prizes were contributed by a dozen leading manufacturers of equipment commonly used by foresters.

J. O. ARTMAN,
Program Chairman,
Kentucky-Tennessee Section.

Candidates for Membership

Candidates for admission (except those for the Student Member grade), advancement, or reinstatement whose membership applications were received in the Society office during the month of November are listed below.

Action regarding the eligibility of these candidates will be taken by the Council as of February 1, 1952. Any communications from voting members relating to the membership eligibility of these candidates should be received in the Society office prior to that date.

The names of these candidates who become members of the grade for which they have applied will be published in subsequent issues of the JOURNAL OF FORESTRY.

Allegheny Section

Junior Grade

Burr, H. L., Box 203, Summersville, W. Va.; W. Va. Univ., B.S.F., 1951.
Johns, W. D., Forester, U.S.F.S., Sheffield, Pa; Pa. State, B.S.F., 1950.

Appalachian Section

Junior Grade

Renfro, J. F., Mountain Home, N. C.; N. C. State, B.S.F., 1951.
Wood, G. W., Jr., 4929 Duke Sta., Durham, N. C.; A.P.I., B.S.F., 1950.

Central Rocky Mountain Section

Junior Grade

Alexander, R. R., Research Forester, U.S.F.S., Fraser, Colo.; Colo. A & M., B.S.F., 1951.

Central States Section

Junior Grade

Fields, J. N., Mgr., Central Paper Co., Inc., Muskegon, Mich.; Mich. State, B.S.F., 1937. Reinstatement.
Korosi, J. J., 1818 La Porte Ave., Whiting, Ind.; Mich. State, B.S.F., 1951.
Marttila, U. M., Forester, U.S.F.S., Cadillac, Mich.; Univ. of Minn., B.S.F., 1927. Reinstatement.
Nowak, C. R., Box 330, La Porte, Ind.; Purdue Univ., B.S.F., 1951.
Samson, D. W., Draftsman, Kaiser-Fraser Corp., Willow Run, Mich.; Univ. of Mich., B.S.F., 1951.

Columbia River Section

Junior Grade

Smith, J. H., 519 S. 14th St., Corvallis, Oreg.; Univ. of Wash., B.S.F., 1950.
Thomson, W. G., Forester, U.S.F.S., Portland, Oreg; Univ. of Wash., B.S.F., 1931; M.F., 1933. Reinstatement.
Yantis, R. A., Cruiser, Douglas County Forest Appraisal Dept., Roseburg, Oreg.; Oregon State, B.S.F., 1951.

Gulf States Section

Junior Grade

Hill, A. L., Jr., General Delivery, Lucedale, Miss.; Univ. of Fla., B.S.F., 1951.
Krier, J. P., Asst. Prof. of Forestry, Stephen F. Austin State College, Nacogdoches, Texas; Univ. of Idaho, B.S.F., 1947; M.S., 1948; Yale, Ph.D., 1951.
Todd, J. E., Tech., Forester, Gaylord Container Corp., Bogalusa, La.; W. Va. Univ., B.S.F., 1950.

Member Grade

McDonald, L., Forester, Farmcraft Associates, Inc., Alexandria, La.; New York State, B.S.F., 1943. (Junior, 1947).

Affiliate Grade

Bozeman, E. B., Asst. Forester, Tremont Lbr. Co., Winnfield, La.; L.P.I., B.S.F., 1950
Dopson, J. F., Treating Inspt., A. W. Williams Inspection Co, Shreveport, La.; L.P.I., B.S.F., 1951.
Ewing, E. R., Forester, Colfax Lbr. and Creosoting Co., Pineville, La.; L.P.I., B.S.F., 1950.
Henderson, J. W., Wood Supt., Lincoln Tbr. Co, Oakdale, La.; L.P.I., B.S.F., 1951.
Jiles, R. A., Jr., Forester, Keith Cranston and Assoc., Ruston, La.; L.P.I., B.S.F., 1948.
Lamkin, S. W., Forester, Frost Lbr. Industries, Inc., Nacogdoches, Texas; L.P.I., B.S.F., 1950.
Martin, J. H., Utilization Forester, Lincoln Tbr. Co., Ruston, La.; L.P.I, B.S.F., 1948. Shreveport, La.; L.P.I., B.S.F., 1950.
Tannehill, W. M., Forester, American Creosote Works, Inc., Winfield, La.; L.P.I., B.S.F., 1950.

New England Section

Junior Grade

Carr, F. X., Forester, U.S.F.S., Rutland, Vt.; Univ. of Mass., B.S.F., 1950.
Savage, E. T., St. Regis Paper Co., Bucksport, Me.; Univ. of Me., B.S.F., 1913. Reinstatement.
Wilson, P. A., Forester, Champion-International Co., Lawrence, Mass.; Univ. of N. H., B.S.F., 1948; Yale, M.F., 1949.

New York Section

Junior Grade

Needham, P. E., 108 Buckingham, Syracuse, N. Y.; Iowa State, B.S.F., 1951.
Zugger, G. T., Jr., Instructor, State Univ. of N. Y., B.S.F., 1951.

Member Grade

Belyea, H. C., Prof., College of Forestry, Syracuse, N. Y.; Univ. of N. B., B.S.F., 1911; Yale, M.F., 1916. Reinstatement.

Northern California Section

Junior Grade

Arment, C. R., Dist. Rgr., U.S.F.S., Susanville, Calif.; Univ. of Calif., B.S.F., 1939.
Dake, C. G., Jr., Gen. Delivery, Glenwood, Calif.; Univ. of Calif., B.S.F., 1951. (Student, 1951).
Ludtke, D. F., 1723 Hamilton Ave., Palo Alto, Calif.; Univ. of Minn., B.S.F., 1941.

Affiliate Grade

Harris, R. F., Assoc. Forest Rgr., Tuolumne County, Calif.
Williams, B. R., Assoc. State Forest Rgr., Calif. Div. of Forestry, Madera, Calif.

Associate Grade

Frandsen, L., Land Comm., Southern Pacific Co., San Francisco, Calif.

Northern Rocky Mountain Section

Junior Grade

Nelson, G. H., Soil Cons., U.S.D.A., Helena, Mont.; Mont. State Univ., B.S.F., 1951.

Ozark Section

Affiliate Grade

Crownover, J. C., Asst. Forester, Dierks Lbr. and Coal Co., Grannis, Ark.; Okla. A & M., B.S., (Forestry), 1950.

Puget Sound Section

Junior Grade

McCartney, R. T., Forester, Everett Lbr. Co., Everett, Wash.; Univ. of Wash., B.S.F., 1950.
Olson, S. E., Forester, White River Branch of Weyerhaeuser Tbr. Co., Enumclaw, Wash.; Univ. of Minn., B.S.F., 1949.

Member Grade

Downen, E. R., Dist. Forest Warden, Wash. State Div. of Forestry, Port Angeles, Wash.; State College of Washington, B.S., (Forestry), 1940. (Junior, 1944).

Affiliate Grade

Burns, G. K., Mgr. and Co-Owner, Burns Lbr. Co., Nelson, B.C., Canada.
Files, R. T., Forestry Aid, U.S.F.S., Renton, Wash.; Univ. of Wash., B.S., (Botany), 1950.
Gilden, E. E., County Ext. Agent, Extension Service, Pullman, Wash.; Wash. State College, B.S., (Forestry), 1947.
Sterling, R. T., Forest Practices Forester, Div. of Forestry, Montesano, Wash.; Wash. State College, B.S., (Agric.), 1950.

Southeastern Section

Junior Grade

Carlson, N. A., Box 112, Orlando, Fla.; Univ. of Fla., B.S.F., 1951. (Student, 1951).
Champion, D. E., Box 347, Starke, Fla.; Univ. of Fla., B.S.F., 1951. (Student, 1951).
Lloyd, C. W., 122 Huron St., Decatur, Ga.; Univ. of Fla., B.S.F., 1951. (Student, 1951).
Schrenk, G. M., Jr., 707 E. Rich Ave., Deland, Fla.; Univ. of Fla., B.S.F., 1951. (Student, 1951).

Southwestern Section

Junior Grade

Jackson, F. L., Dist. Forest Rgr., Gila National Forest, Silver City, N. Mex.; Utah State, B.S.F., 1931; M.S., 1933.

Member Grade

Johnson, H. G., Dist. Forest Rgr., U.S.F.S., Tijeros, N. Mex.; Univ. of Minn., B.S.F., 1933. (Junior, 36R50).

Affiliate Grade

Broadhead, A. H., Forestry Aid, Sitgreaves National Forest, Pinedale, Ariz.; Okla. A & M., B.S., (Forestry), 1951.

Upper Mississippi Valley Section

Junior Grade

Conover, D. F., Research Asst., Univ. of Minn., Minneapolis, Minn.; Pa. State, B.S.F., 1951.

Washington Section

Junior Grade

Merritt, R. W., Cartographic Photogrammatic Aide, Navy Hydographic Office, Suitland, Md.; Iowa State, B.S.F., 1951.

Wisconsin-Upper Michigan Section

Affiliate Grade

Bourdow, R. T., Forester, Wisconsin Cons. Dept., Tomahawk, Wisc.; Mich. College of Mining and Tech., B.S., (Forestry), 1951.
Parks, W. R., Forester, Ontario Paper Co. Ltd., Gore Bay, Ontario, Canada; Univ. of Toronto, B.S., (Forestry), 1949.

Foreign

Corresponding Grade

Donis, C. A., c/o Ineac Yangambi, Belgian Congo, Africa; Inst. Agronomique de l'Etat a Cembleux, Belgium.

New Members and Advancements

Individuals who became members of the grades indicated during the month of November are listed below. They are eligible for participation in the activities of the Society of American Foresters, including meetings and projects of Sections, Chapters, Divisions, and Committees.

Allegheny Section

Student Grade

PENNSYLVANIA STATE COLLEGE

Branch, D. W.
Gerhold, H. D.
Graef, W. J., Jr.
Holt, W. R.
Kemp, G. R., Jr.
Krewson, C. F.
Montgomery, L. H.
Schrey, F. J.
Sheble, E., Jr.
Shunk, B. H.
Wenner, E. J.

WEST VIRGINIA UNIVERSITY

Bailey, W. J., Jr.
Calhoun, H. K.
Ferguson, R. B.
Haught, A. E., Jr.
Stone, J. A.

Junior Grade

Antonis, J., 5641 N. 20th St., Philadelphia, Pa.
Fox, M. F., Ninth St., Freedom, Pa.
Hobart, W. L., 502 Main St., Laurel, Md.
Keiser, D. F., 24 Hawthorne Rd., West Lawn, Pa.

Member Grade

Bandekow, R. J., 89 Mountain Ave., Maplewood, N. J.
Carpenter, C. H., New York and Penn. Co., Lock Haven, Pa.
Johnson, J. E., 112 E. Lamb St., Bellefonte, Pa.
Reigner, I. C., N. E. Forest Expt. Sta., Bethlehem, Pa.

Appalachian Section

Student Grade

NORTH CAROLINA STATE COLLEGE

Bean, S. D.
Bennett, J. W.
Bideaux, R. O.
Blanchard, G. M.
Boger, H. J.
Corbett, K. M., Jr.
Crook, J. D., Jr.
Dorward, R. E.
Eggleston, R. H.
Gresham, H. H.
Hardin, T. N.
Harris, H. G., Jr.
Harris, H. M.
Hayes, J. M.
Hinshaw, J. S.
Holmes, M. L., Jr.
Hughes, S. M.
Jackson, C. A., Jr.
Jordan, E. N.
Lane, E. B., Jr.
Langley, W. R., Jr.
Ledbetter, J. I.
LeRoy, J. L.
Morison, D. W.
Parris, R. B., Jr.
Peroni, G. P.
Phelps, R. B.
Reid, J. B.
Reyns, R. G.
Ross, V. R.
Sly, R. E.
West, A. A.

Junior Grade

Keller, W. M., Winston Salem, N. C.

Member Grade

Rettberg, H. C., Sunset, S. C.

Affiliate Grade

Flick, A. W., Jr., 122 N. 21st Ave., Hopewell, Va.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Jones, S. H.

Junior Grade

Klemmedson, J. O., Colo. A & M., Ft. Collins, Colo.

Central States Section

Student Grade

MICHIGAN STATE COLLEGE

Hensley, K. D. — Klawitter, R. A.
Hull, R. D. — Pangborn, G. C.
Kent, L. P.

UNIVERSITY OF MICHIGAN

Eberhardt, W. E. — Wepfer, R. W.
Mason, R. R.

PURDUE UNIVERSITY

Bamping, J. H. — Payne, J. H.
Courtney, E. W. — Veregge, E. J.
Gurley, P. A. — Wright, J. R.
Heighes, D. W.

Junior Grade

Brickman, T. L., Box 132, Rollin, Mich.
Goodwin, D. K., 721 N. Wallace Ave., Indianapolis, Ind.

Member Grade

Hunson, R. K., 2588 East Saginaw St., East Lansing, Mich.
O'Connor, G. W., 5700 S. Seeley Ave., Chicago, Ill.
Olson, G. E., 1416 W. Carpenter, Midland, Mich.
Quigley, K. L., Central States Forest Exp. Sta., Columbus, Ohio

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Asher, J. E. — Hagenstein, P. R.
Baker, R. J. — Larson, J. E.
Chapman, D. W. — Naish, R. A.
Christie, J. L., Jr. — Smith, G. S.
Fallgatter, W. B. — Steers, I. A.
Green, P. L.

Junior Grade

McCormack, M. H., 200 W. 1st Ave., N., Roseburg, Oreg.
O'Keefe, E. H., c/o U.S.F.S., Wahlport, Oreg.

Member Grade

Chriswell, H. C., Union Creek Rgr. Service, Prospect, Oreg.
Compton, L. M., Box 575, La Grande, Oreg.

Affiliate Grade

Ross, B. F., 703 Beach Drive, Seaside, Oreg.

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Clark, W. D., Jr. — Mizell, L.
Eusminger, A. B. — Ward, C. E.
Ford, E. M. — Wright, L. O., Jr.
Hastings, E. F.

Junior Grade

Sessions, L. C., Box 649, Jackson, Miss.

Member Grade

Kowal, R. J., Forest Insect Lab., Gulfport, Miss.

Affiliate Grade

Futch, J. M., 510 N. Third St., West Monroe, La.

Inland Empire Section

Member Grade

Glaus, R. H., Orofino, Idaho

Intermountain Section

Junior Grade

Miller, R. L., 1285½ Whittier, Idaho Falls, Idaho

Nottingham, C. R., Riggins Rgr. Sta., Riggins, Idaho
Stevens, L. A., 458 W. 6th St., W., St. Anthony, Idaho

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Raymond, E. W.

UNIVERSITY OF MAINE

Beal, F. S. — Reynolds, A. W.
Brubaker, R. G. — Wheeler, R. H.
David, R. R.

Junior Grade

Hopkins, H. E., North Eastham, Mass.

Member Grade

Brann, E. J., Box 78, Hampden Highlands, Me.
Breck, R. W., 9 Myrtle St., Milford, N. H.
Lachance, P. E., 14 Place D'Aiguillon, Quebec, Can.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Carey, W. H. — Noble, C. L.
Curran, J. R. — Rose, D. N.
Dzurissin, A. F., Jr. — Schubert, T. H.
Glowka, A. M. — Woodcock, L. C.
Granfelt, C. E.

Junior Grade

Catalanotto, L. G., 101 Foxhurst Rd., Oceanside, N. Y.
Eckert, J. J., R.F.D. #1, Wallkill, N. Y.
Franke, R. P., 380 E. 29th St., Brooklyn 26, N. Y.

Associate Grade

Connola, D. P., New York State Science Service, Albany, N. Y.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Agrons, B. Z. — Nelson, T. W.
Annand, P. G. — Nile, J. B.
Brichacek, O. J. — Perry, J. L.
Everett, D. W. — Reukema, D. L.
Gentry, G. I. — Rose, J. A.
Hall, E. J. — Russ, R. F.
Lavender, J. S. — Trammell, M. L.
Lowe, W. H. — Wasson, R. B.

Junior Grade

Heilman, E. G., 1080 Santa Ynez Way, Sacramento 16, Calif.
Reynolds, R. D., 2731 Shasta Rd., Berkeley, Calif.
White, P. H., 3rd Eng. Bn., Co. B., A.P.O. #24, c/o P.M., San Francisco, Calif.

Member Grade

Taylor, J. E., Big Creek Ranger Sta., Big Creek, Calif.

Northern Rocky Mountain Section

Junior Grade

Yahvah, E. L., Box VV, Rexford, Mont.

Member Grade

Cloninger, R. T., Fontine, Mont.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Gould, T. L. — Plummer, J. L.
Green, J. W. — Smith, H. W.

Member Grade

Bixby, T. P., 403 East 11th St., Ellis, Kansas
Mann, W. F., Jr., 804 Cedar St., Crossett, Ark.

Affiliate Grade

Hooker, G. B., Warren, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Bishop, D. M. — Simmons, D. V.
Lawson, W. L. — Sorsdahl, D. H.
Madsen, E. K. — Swanson, K. E.
Matthias, J. S. — Wagar, J. A.
Monahan, J. E. — Welsh, D.
Pitzler, D. W.

Junior Grade

Meister, K., General Delivery, Enumclaw, Wash.

Member Grade

Williams, A. S., 119 Pender St., West Vancouver, B.C., Can.

Southeastern Section

Student Grade

ALABAMA POLYTECHNIC INSTITUTE

Abt, P. — Payne, T. P.
Buettner, R. T. — Sharp, J. D.
Crain, L. B. — Smith, D. J.
Dale, C. N., Jr. — Smith, R. I.
Gandy, W. V. — Stallworth, D. R.
Gibson, G. E. — Struck, C. H.
Graves, J. H., Jr. — Tanner, R. G.
Johnson, C. D. — Watson, W. J.
Kent, N. C. — Woods, D. W.

UNIVERSITY OF FLORIDA

Carlson, N. A. — Lloyd, C. W.
Champion, D. W. — Schrenk, G. M., Jr.

Junior Grade

Barnes, R. L., 1836 N. W. 2nd Ave., Gainesville, Fla.
Deason, J. W., Box 244, Tallassee, Ala.
Douglas, F. L., Box 249, Starke, Fla.
Jackson, W. A., Box 1644, Pensacola, Fla.
Johnson, L. J., 230 N. Barcelona St., Pensacola, Fla.
Jones, F. E., Box 125, Columbiana, Ala.
Parker, D. C., Centreville, Ala.
Rowe, R. H., Jr., Box 127, Madison, Fla.
Uhler, J. R., Box 40 A, Route 3, Milledgeville, Ga.

Member Grade

Juskie, B., 2830 Bay Haven Drive, Tampa, Fla.
Wiley, H. M., 907 Euclid Ave., Waycross, Ga.

Affiliate Grade

Parker, J. M., Box 71, Blountstown, Fla.

Southwestern Section

Junior Grade

Maxey, C. A., Box 373, Aztec, N. Mex.
Neal, R. L., Jr., Box 1490, Flagstaff, Ariz.
Riddle, D. D., Box 523, Winslow, Ariz.

Upper Mississippi Valley Section

Student Grade

IOWA STATE UNIVERSITY

Hawk, H. E. — Ruppelt, J. M.
Knutsen, S. K. — Tobiaski, R. A.
Martin, T. C.

UNIVERSITY OF MINNESOTA

Tousley, R. S.

Junior Grade

Larie, E. G., 2716 Stevens Ave., Minneapolis, Minn.

Washington Section

Junior Grade

Schwartz, C. M., 1818 24th St., S. E., Washington, D. C.

Wisconsin-Upper Michigan Section

Junior Grade

Landphier, G. L., Route #1, Waunakee, Wis.

Dues Deductible

In filing U. S. income tax reports, all members may classify dues paid to the Society of American Foresters as deductible expenses.

Dues for 1952 should be paid promptly and in no case should they remain unpaid after June 30, 1952. Members whose dues are not paid by that date will receive no further issues of the JOURNAL OF FORESTRY until dues are paid.

Canadian members may pay their dues in Canadian funds. All subscriptions to the JOURNAL OF FORESTRY must be made in U. S. funds.

Consulting Foresters

Approved for Listing on January 1, 1952, by the
SOCIETY OF AMERICAN FORESTERS

The following List of Consulting Foresters is published by the Society of American Foresters for the information of prospective clients.

Individuals listed are members of the Society of American Foresters and as such are believed qualified and competent to perform the technical servies specified. However, the Society cannot assume responsibility for the actions of individuals or firms listed.

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Code of Fields of Specialization

1. Arboriculture and tree preservation.
2. Cost and economic studies of forest operations.
3. Forest and wood utilization.
4. Forest management and silvicultural practice.
5. Forest protection from disease.
6. Forest protection from fire.
7. Forest protection from insects.
8. Forest taxation.
9. Game and wildlife management.
10. Logging engineering.
11. Market studies and trade promotion (forest products).
12. Naval stores operations.
13. Pulpwood operations.
14. Range management.
15. Surveying and mapping.
16. Timber valuation and appraisal.
17. Timber volume and quality estimates.
18. Tree planting and reforestation; reproduction studies.
19. Wood preservation.
20. Wood seasoning.
21. Wood technology.

Raymond D. Adolph, 44 Roe Park, Highland Falls, New York.
Territory: Southeastern New York.
Specialization: 4, 5, 6, 7, 18.

Thos. W. Alexander, Consulting Forester, Waynesville, North Carolina.
Territory: South, Central States, and Appalachians.
Specialization: 2, 4, 11, 16, 17.

John R. Allison, 483 W. Palmetto Street, Florence, South Carolina.
Territory: Eastern South Carolina.
Specialization: 3, 4, 6, 7, 13, 16, 17, 18.

Glenn O. Antonie, Consulting Forester, Box 134, Linden, Alabama.
Territory: Alabama Mississippi.
Specialization: 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 16, 17, 18. Also agent for absentee timber owners; timber sales and cutting supervision; forest litigation.

Milton Applefield, Consulting Forester, 10 Glendale Road, Jacksonville, North Carolina.
Territory: South coastal plain.
Specialization: 3, 4, 10, 13, 15, 16, 17, 18. Also sawmill efficiency studies; litigation and damage claims.

S. Gayley Atkinson, Consulting Forester, Huntingdon Road, Huntingdon Valley, Pennsylvania.
Territory: Pennsylvania.
Specialization: 1, 18.

Henry L. Bango, Consulting Forester, P.O. Box 4072, Shreveport, Louisiana.
Territory: Northern Louisiana.
Specialization: 3, 4, 5, 16, 17, 18. Also purchase and sale of timbered properties.

George Banzhaf & Company, 662 North Water St., Milwaukee 2, Wisconsin.
Territory: Lake States.
Specialization: 2, 4, 13, 15, 16, 17.

Belanger and Bourget, Land Surveyors and Forest Engineers, 86 Cote de la Montagne, Quebec, Canada.
Consultant: M.-Albert Bourget.
Territory: Canada, especially Quebec.
Specialization: 2, 3, 4, 10, 11, 13, 15, 16, 17, 19, 20, 21. Also boundary lines.

Bigley and Feiss, Foresters, Inc., 490 East Broadway, Eugene, Oregon.
Consultants: Sherman Feiss, John Venator.
Territory: Washington, Oregon, California.
Specialization: 2, 3, 4, 6, 15, 16. Also sustained yield plans, supervision of contract logging, and timberland sales.

Bishop Brothers, Consulting Foresters, Marion, South Carolina.
Consultant: H. F. Bishop.
Territory: South Carolina and southeastern U.S.
Specialization: 3, 4, 6, 8, 10, 13, 15, 16, 17, 18.

Jack C. Blakeney, Consulting Forester, % Hickory Handle Co., Inc., P. O. Box 253, Batesburg, South Carolina.
Territory: South Carolina.
Specialization: 3, 4, 6, 7, 11, 13, 16, 17, 18.

Lewis M. Boice, Consulting Forester, Orangeburg, South Carolina.
Territory: Within 100 miles of Orangeburg.
Specialization: 4, 15, 16, 17.

Gordon Bowker, Consulting Forester, % J. W. Lyle, Richburg, South Carolina.
Territory: Eastern U. S.
Specialization: 4, 9, 15, 16, 17, 20. Advice on plantation management. Also registered land surveyor.

Allen W. Bratton, Consulting Forester, Shelterwood, Cooperstown, New York.
Territory: Northeast.
Specialization: 4, 5, 6, 7, 8, 11, 15, 16, 17, 18.

Brown and Brown, Forest Engineers, 614 Lewis Building, Portland 4, Oregon.
Consultants: Eugene R. Walsh (Associate Member), Samuel Rotschy.
Territory: Pacific coast.
Specialization: 2, 3, 4, 6, 8, 10, 11, 12, 15, 16, 17, 18.

Charles H. Bunting, Timber Cruiser, Room 717, 300 Montgomery Street, San Francisco, California.
Territory: California.
Specialization: 2, 10, 15, 16, 17.

California Foresteering, 429 Main Street, Placerville, California.
Consultant: Wm. B. Berry.
Territory: California pine region.
Specialization: 2, 3, 4, 10, 16. New solutions to the old problems of logging, milling, and timber management.

N. D. Canterbury, Consulting Forester, 4214 St. Emanuel Street, Apt. 3, Houston 4, Texas.
Territory: Texas and southeastern U. S.

Floyd F. Clark, Consulting Forester, Sky Ranch, Box 75, Ocala, Florida.
Territory: Southeast.
Specialization: 2, 3, 4, 6, 8, 9, 12, 13, 14, 15, 16, 17, 18. Also sale of timber properties; combined timber—cattle operations in the Southeast; insurance company representation for timber and range land.

T. S. Coile, Consulting Forester and Soil Scientist, Duke University, Durham, North Carolina.
Territory: Virginia to Texas; northern Rockies; Pacific Northwest.
Specialization: 4, 15, 16, 17, 18. Also determination of productive capacity of land for forest crops; soil evaluation; and land management.

Connwood, Inc., South Main Street, Cheshire, Connecticut.
Consultants: Ralph C. Hawley, Michael M. Pochan, Jr.
Territory: Connecticut and adjacent areas.
Specialization: 3, 4, 10, 11, 13, 15, 17, 18, 19, 21.

Consulting Foresters, 4970 Kingsley Drive, Indianapolis, Indiana.
Consultants: Robert F. Davis, D. K. Goodwin.
Territory: Indiana.
Specialization: 4, 10, 11, 16, 17, 18.

Grover M. Conzet, 220 Garden Lane, Decatur, Georgia.
Territory: Eastern U. S.
Specialization: 3, 6, 9, 11. Also training of fire crews, training in foremanship and sawmill operation, and general training methods.

David B. Cook, Consulting Forester, 12 McPherson Terrace, Albany 6, New York.
Territory: Eastern New York.
Specialization: 4, 8, 9, 13, 16, 18.

Philip T. Coolidge, Consulting Forester, 31 Central Street, Bangor, Maine.
Territory: Not limited.
Specialization: 2, 4, 8, 10, 13, 15, 16, 17, 18. Also farm appraisal.

William T. Cox, Consulting Forester and Biologist, 2186 Doswell Avenue, St. Paul 8, Minnesota.
Territory: General.
Specialization: Appraisals of forest properties; development of furbearers and other wildlife; selection of new locations for woodworking plants.

James W. Craig, Consulting Forester, Leavell Woods Station, Jackson, Mississippi.
Consultants: James W. Craig, Keith E. Steckel.
Territory: Mississippi and the South.
Specialization: 3, 4, 6, 13, 15, 16, 17, 18. Also complete line of forestry supplies.

Keith Cranston & Associates, Leland, Mississippi.
Territory: Mississippi delta and hardwood bottomlands, and Gulf States.
Specialization: 2, 3, 4, 10, 11, 13, 16, 17. Retained in consultant capacity by operating mill firms and managing privately owned hardwood and pine tracts. Supplemental cruising services.

C. P. Cronk, 10 Crown Ridge Road, Wellesley, Massachusetts.
Territory: Not limited.
Specialization: Studies in industrial forestry, with particular reference to problems in utilization, production, merchandising, and public relations.

John M. Crowl, Consulting Forester, 704 Phillip Street, Carton City, Nevada.
Territory: California, Nevada.
Specialization: 1, 2, 3, 5, 6.

Lucas M. Dargan, Consulting Forester, P. O. Box 167, Darlington, South Carolina.
Territory: Coastal Carolinas.
Specialization: 4, 9, 16, 17, 18. Also forest mapping and timber location studies from aerial photographs.

Randle J. Dedeaux, Consulting Forester, P. O. Box 52, Perkinson, Mississippi.
Territory: Southern Mississippi; longleaf and slash pine types.
Specialization: 4, 13, 15, 17. Also growth studies, timber marking and marketing, and agent for absentee timberland owners.

W. T. Doherty, Consulting Forester, 421 N. Morningside, Albuquerque, New Mexico.
Territory: Arizona, New Mexico.
Specialization: 4, 15, 16, 17. Also land classification.

William A. Eastman, Jr., Consulting Forester, William A. Eastman & Co., Inc., 410 Green Building, Seattle 1, Washington.
Territory: Pacific Northwest.
Specialization: 10, 15, 16, 17, 18. Also preparation and administration of timber sales, land appraisal, timberland brokerage, and timberland management.

Nils B. Eckbo, Industrial Forestry Consultant, 26 Rhodes Avenue, Parktown, Johannesburg, South Africa.
Territory: Southern Africa.
Specialization: Industrial forestry.

Inman F. Eldredge, Sr., 1354 Moss Street, New Orleans 19, Louisiana.
Territory: Lower South.
Specialization: Resource surveys for large operations; advice and counsel in large-scale land purchase programs; consultation with forestry staffs on management policy and practice in larger operations.

L. J. Enright, Consulting Forester, P. O. Box 602, State College, Pennsylvania.
Territory: Pennsylvania; not limited.
Specialization: 1, 6, 15, 18. Also park management and policy; landscape planting and design.

Charles F. Evans, Consulting Forester, 2867 Piedmont Road, Atlanta, Georgia.
Territory: Southeastern U. S.
Specialization: 4, 6, 16, 17, 18. (Registered Forester under Georgia state law.)

John B. Evans, Consulting Forester, 57 Prospect Street, Lancaster, New Hampshire.
Territory: Northeast.
Specialization: 4, 6, 15, 16, 17, 18.

Farmcraft Associates, Inc., Forest Managers, 5402 Almeda, Houston, Texas and Box 4344, Alexandria, Louisiana.
Consultants: Stuart F. Clark, Leo McDonald.
Territory: Southern U. S.
Specialization: Forest investments and technical forest and range management for private and industrial holdings.

David S. Findlay, Consulting Forester, 20 East 5th Street, Jamestown, New York.
Territory: Western New York and Pennsylvania.
Specialization: 4, 15, 16, 17.

George M. Fisher, Consultant Landscape Forester, P. O. Box 300, Tyler, Texas.
Territory: Northeastern Texas.
Specialization: 1, 5, 7, 9, 18. Also city forestry and shade tree problems; landscape design, construction, and maintenance; forest parks and recreational planning.

C. V. Fisk, Consulting Forester, P. O. Box 524, Chariton, Iowa.
Territory: Iowa, Missouri, Nebraska, Kansas, Illinois.
Specialization: 4, 9, 16, 17. Also farm forestry.

Reginald D. Forbes, Consulting Forester, R.F.D. 1, Ambler, Pennsylvania.
Territory: Eastern U. S.
Specialization: 4, 6, 17, 18. Also forest resource surveys of timber available to manufacturing plants in specified territories.

Forestry Consulting Services, 720 South Durand, Jackson, Michigan.
Consultant: George D. Blair.
Territory: Michigan.
Specialization: 1, 2, 4, 11, 16, 19. Also various forest growth and vegetative services to public utility industries in the Midwest.

Edwin H. Francis, Consulting Forester and Landscape Engineer, Varysburg, New York.
Territory: Western New York.
Specialization: 4, 5, 6, 7, 18. Also landscape and recreational planning and construction on estates and small homes.

R. C. Fraunberger, Forest Products Business Consultant, 418 Park View Drive, Wynnewood, Pennsylvania.
Specialization: 2, 3, 4, 10, 11, 16, 17, especially in hardwoods, domestic and foreign.

Emanuel Fritz, Consulting Forester, 102 The Uplands, Berkeley 5, California.
Territory: California; pine and redwood.
Specialization: 2, 3, 4, 6, 10, 11, 16, 17, 18, 19, 20, 21. Also consultant on state forest and park management and policy.

LeRoy Frontz, Consulting Forester, Allenwood, Pennsylvania.
Territory: Eastern U. S.
Specialization: 3, 4, 5, 6, 7, 9, 16, 17, 18. Also landscaping, forest and ornamental nurseries, farm forestry, forest parks and recreation, landuse planning, soil conservation, farm evaluation and appraisal.

John D. Gilmour, Consulting Forester, 5823 McLynn Avenue, Montreal, Quebec, Canada.
Territory: Not limited.
Specialization: 2, 4, 8, 10, 16, 17. Also tropical logging.

Nathan B. Golub, Consulting Forester, Buckstone Farm, Washington Crossing, Pennsylvania.
Territory: Pennsylvania.
Specialization: 4, 15, 16, 17. Also water management plans. Registered engineer in Pennsylvania.

Winslow L. Gooch, Forestry Consultant, West Point, Virginia.
Territory: United States, Central and South America, Africa, Europe.
Specialization: 2, 3, 8, 11, 13, 15, 16, 17, 20, 21. Also investigations on vegetable tannin research, foreign cabinet timbers, and forest litigation.

E. W. Graeber, Consulting Forester, 303 Hillcrest Road, Raleigh, North Carolina.
Territory: North Carolina.
Specialization: 4, 6, 13, 16, 17, 18. Also buying and selling timber and timberlands as service to either buyer or seller; adjusting problems arising from over-cutting or trespass.

Grant and Evans, Licensed Engineers, 415 Pacific Building, Roseburg, Oregon.
Consultant: Richard C. Grant.
Territory: Oregon.
Specialization: 10, 15, 16, 17.

Norman H. Gray, Consulting Forester, Fryeburg, Maine.
Territory: Maine, New Hampshire.
Specialization: 3, 4, 13, 15, 16, 17, 18.

T. F. Grayson and Company, Commercial Foresters, P. O. Box 110, Prescott, Arkansas.
Territory: Southeastern U. S.
Specialization: 2, 4, 8, 10, 11, 13, 15, 16, 17, 18. Also timber purchase, sale, management, and millsite locations.

Green's Timber Service, Johnson City, Tennessee.
Consultant: L. Stanley Green.
Territory: Southeastern U. S.
Specialization: 2, 3, 4, 6, 10, 13, 16, 17, 18. Also custom sawmilling.

Clarence W. Griffith, 1001 Ouachita Bank Building, Monroe, Louisiana.
Territory: United States and Central America.
Specialization: 4, 15, 16, 17. Also purchase and sale of timbered properties.

Alvin B. Hafer, Consulting Forester, Laurinburg, North Carolina.
Territory: North Carolina, South Carolina, and Southeast.
Specialization: 4, 15, 16, 17. Also purchase and sale of timbered properties.

Albert G. Hall and Associates, 1740 K Street, NW, Washington 6, D. C.
Specialization: 2, 3, 4, 5, 6, 7, 8, 11, 13, 16, 17, 18. Also Washington representation.

Giles G. Hall, Forest Consultant, 402 Cumberland Avenue, North Augusta, South Carolina.
Territory: South Carolina, Georgia.
Specialization: 2, 3, 4, 5, 6, 7, 10, 11, 13, 16, 17, 18. Also tree pruning in planted stands.

Hammon, Jensen, and Wallen, Mapping and Forestry Services, 1209 8th Avenue, Oakland 6, California.
Consultants: Herbert A. Jensen, Arnold F. Wallen.
Territory: Principally California, Nevada, and the Southwest, but also elsewhere.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18. Also planimetric and topographic mapping, land net delineation, general land classification for appraisal purposes and ranchland management, and aerial photogrammetric consulting service. Emphasis on aerial photo techniques in all activities.

David H. Hanaburgh, Consulting Forester, Buchanan, New York.
Territory: Northeast.
Specialization: 2, 3, 4, 9, 10, 11, 13, 16, 17. Also negotiation of rights for hunting, fishing, trapping, and water storage.

Ralph C. Hawley, Consulting Forester, R. D. 1, West Cheshire, Connecticut.
Territory: Northeast.
Specialization: 4, 6, 16, 18.

Ralph W. Hayes, Consulting Forester, 2241 Myrtle Avenue, Baton Rouge, Louisiana.
Territory.: Gulf States.
Specialization: 2, 3, 13, 15, 16, 17. Also investigation and settlement of claims regarding timber in use in the South.

K. J. Helmick, Consulting Forester, 50 Circle Drive, Fort Collins, Colorado.
Territory: Colorado, Wyoming, South Dakota, Utah, New Mexico.
Specialization: 4, 10, 15, 16, 17.

Hiram L. Henderson, Manufacturer of Dry Kilns, 119 Stone Ridge Drive, Syracuse, New York.
Territory: Principally eastern states.
Specialization: 20. Also construction of lumber dry kilns.

Halsey M. Hicks, Consulting Forester, R. F. D. 3, Brattleboro, Vermont.
Territory: Not limited.
Specialization: 2, 3, 4, 8, 15, 16, 17.

Monterey L. Holst, Consulting Forester, P. O. Box 125, East Greenwich, Rhode Island.
Territory: New England.
Specialization: 3, 4, 6, 9, 10, 13, 15, 16, 17, 18, 21.

Douglas F. Horan, Consultant Forester, 321 South Iowa Avenue, Lakeland, Florida.
Territory: Florida.
Specialization: 4, 11, 15, 16, 17.

Richard F. Howard, 15 Cherry Street, Franklinville, New York.
Territory: Pennsylvania, New York, New England.
Specialization: 3, 4, 6, 15, 16, 17, 18.

T. M. Howerton, Jr., Consulting Forester, Madison, Florida.
Territory: Southeastern states.
Specialization: 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 15, 16, 17, 18. Also forest land acquisition, marketing of forest products, and land management.

James L. Huff, Consulting Forester, Dillon, South Carolina.
Territory: North Carolina, South Carolina.
Specialization: 4, 6, 10, 16, 18.

G. W. Hult, Consulting Forester, 3029 Johnson Street, Corvallis, Oregon.
Territory: Oregon, California, and southwestern U. S.
Specialization: 4, 16, 17. Also estate woodlands management; negotiation of cooperative sustained yield units; timber sales, acquisition, and exchanges.

LeRoy W. Huntington, Consulting Tropical Forester, 52 Wesley Street, Baldwin, New York.
Territory: Latin America, Orient, Africa.
Specialization: 2, 3, 4, 10, 11, 15, 16, 17, 18; and tropical hardwoods.

R. Wilson Hutchison, Consulting Forester and Logging Engineer, 167 Walnut Lane, Eugene, Oregon.
Territory: Washington, Oregon, California.
Specialization: 2, 3, 4, 6, 10, 15, 16, 17. Registered professional engineer of the State of Oregon.

Gorham E. Jackson, Consulting Forester, 604 West Main Street, Washington, North Carolina.
Territory: Eastern North Carolina, southeastern Virginia. All forest types.
Specialization: 2, 4, 6, 9, 10, 13, 15, 16, 17, 18. Also investigations of forest resources for pulp and paper companies, and land agent for absentee timberland owners.

M. E. Jelley, Consulting Forester, 122 Haywood Avenue, Chattanooga 5, Tennessee.
Territory: Southeastern and eastern states.
Specialization: 2, 3, 4, 10, 11.

David G. Jennings, Consulting Forester, 206 Chestnut Street, Port Jefferson, New York.
Territory: New York.
Specialization: 1, 3, 4, 6, 15, 18.

Ralph S. Johnson, Laurinburg, North Carolina.
Territory: Eastern Carolinas.
Specialization: 3, 4, 6, 13, 15, 16, 17.

Robert W. Jones, Route 3, Box 579-F, Bellevue, Washington.
Territory: Washington.
Specialization: 10, 11, 15, 16, 17, 18. Also photogrammetry and court cases concerning boundary disputes.

E. V. Jotter, Consulting Forester, 30 Cedarlawn Drive, Dayton 5, Ohio.
Territory: Ohio.
Specialization: 3, 4, 6, 9, 11, 16, 17, 18. Also development and management of community forests, conservation education, cooperation with soil conservation districts.

Stuart G. Keedwell, Consulting Forester, Emporia, Virginia.
Territory: Eastern and southern U. S.
Specialization: 3, 4, 10, 11, 13, 15, 16, 17. Also forest litigation and purchase and sale of land and timber.

John F. Kellogg, Forester, Flora, Louisiana.
Territory: Louisiana; pine and hardwood.
Specialization: 4, 5, 11, 16, 17.

H. Thorn King, Consulting Forester and Land Surveyor, Hancock, New Hampshire. (S.A.F. Affiliate Member.)
Territory: Southwestern New Hampshire.
Specialization: 2, 3, 4, 15, 16, 17, 18. Also private and farm forestry, scaling, marking, surveying, and title investigation.

Joseph C. Kircher, Consulting Forester, Mount Dora, Florida.
Territory: Southern U. S.
Specialization: 2, 4, 6.

G. E. Knapp, Consulting Forester, 661 Forest Hill Road, Macon, Georgia.
Territory: Southern states.
Specialization: 2, 4, 10, 11, 13, 16, 17, 18.

Robert F. Knoth & Company, Foresters, Appraisers, Surveyors, 39 Broad Street, Charleston 3, South Carolina.
Consultant: Robert F. Knoth.
Territory: American, Canadian and tropical timberlands. No restrictions.
Specialization: 4, 6, 10, 11, 13, 15, 16, 17, 18. Land agent for absentee timberland owners; foreign timberland investigations; veneer log inspection and procurement.

The Langdale Company, P. O. Box 980, Valdosta, Georgia.
Consultants: Harley Langdale, Jr., T. E. Connell.
Territory: Georgia, northern Florida; slash pine belt.
Specialization: 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19. Also custom sawing.

Frank J. Lemieux, Consulting Forester, 734 Whitney Building, New Orleans, Louisiana.
Territory: Southern states, Mexico, Central and South America.
Specialization: 2, 4, 6, 13, 15, 16, 17.

Paul C. Lemon, Consulting Forester, State College, Albany 3, New York.
Territory: New York.
Specialization: 1, 6, 9, 14. Also commercial pilot, applications of aviation to forestry.

T. A. Liefeld, Consulting Forester, Thomasville, Georgia.
Territory: Florida, Georgia.
Specialization: 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 16, 17, 18.

Harvey J. Loughead, Consulting Forester, 15 East Forest Road, Biltmore Station, Asheville, North Carolina.
Territory: Eastern U. S.
Specialization: 3, 4, 12, 13, 16, 17. Also watershed management.

Ludwig Bros., Engineers, 608 South Fair Oaks Avenue, Pasadena 2, California.
Consultant: Gordon W. Ludwig.
Territory: California.
Specialization: 2, 4, 6, 7, 15, 16, 17, 18. Also specialist in soils and soil science. Associated with registered civil engineers specializing in sewage and water treatment.

Donald K. Maissurow, Consulting Forester, New Haven Avenue, Derby, Connecticut.
Territory: New England.
Specialization: 1, 4, 5, 7, 15, 16, 17, 18. Also landscape forestry.

Mason, Bruce, & Girard, Consulting Foresters, American Bank Building, Portland 5, Oregon.
Consultants: David T. Mason, James W. Girard, Karl D. Henze, Gilbert M. Bowe, Lyle Cummings, Vernon Good.

Earl M. McChesney, Consulting Forester, 4 New York Street, Bangor, Maine.
Territory: Maine, New York.
Specialization: 1, 4, 15, 17, 18. Also personnel work.

Rex D. McCord, Consulting Forester, 703 South Crest Road, Chattanooga, Tennessee.
Territory: North Georgia, north Alabama, east Tennessee.
Specialization: 3, 4, 16, 17.

Thomas A. McFarland, Consulting and Contracting Forester, 60 Holman Avenue, Athens, Georgia.
Territory: Georgia.
Specialization: 2, 4, 10, 15, 16, 17. Also timber, timberland, and farmland broker.

Philip C. Meinzer, Consulting Forester, Route 3, Kokomo, Indiana.
Territory: Indiana.
Specialization: 1, 4, 16, 17, 18.

Fred B. Merrill, Consulting Forester, Box 66, Zachary, Louisiana.
Territory: Mississippi and Louisiana, within 100 miles of Baton Rouge.
Specialization: 4, 5, 6, 7, 11, 13, 16, 17. Also buying and selling timberlands; training estate and company personnel; and Gaylord pulpwood dealer in East and West Feliciana Parishes.

William F. Milliken, Timberland Consultant, Box 191, Williston, South Carolina.
Territory: South Carolina, eastern Georgia.
Specialization: 3, 4, 6, 11, 13, 15, 16, 17, 18. Also sustained yield plans and contract tree planting; timberland agent for absentee timberland owners.

William J. Mills, Forest Engineer, 201 Volunteer Building, Chattanooga 2, Tennessee.
Territory: Southeastern states, Mexico.
Specialization: 3, 4, 11, 13, 15, 16, 17.

Malcolm A. Milne, Consulting Forester and Landscape Engineer, 433 Clay Avenue, Rochester, New York.
Territory: Central and western New York.
Specialization: 1, 5, 7, 18. Also landscaping, estate development and management, and forest recreation.

R. B. Milne, Consulting Forester, Box 371, Petersburg, Virginia.
Territory: Eastern states; all forest types.
Specialization: 3, 4, 10, 16, 17.

Stuart Moir, Forest Counsel, Western Forestry and Conservation Association, 712 U. S. National Bank Building, Portland 4, Oregon.
Territory: Western states.

Wm. Mollenhauer, Jr., Landuse Consultant, 186 West Avenue, Pitman, New Jersey.
Territory: New Jersey.
Specialization: 4. Also flood and erosion control; ecological surveys of plant and animal relations in forest and rural areas; economic and social surveys of forest and rural areas, including labor relations.

Robert Moore, Consulting Forester, Danville, Pennsylvania.
Territory: Not restricted.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18, 19. Also bankruptcy cases, trade association work, coal lands, trusteeship cases, litigation and damage claims, estate problems.

W. Morris Morgan, Consulting Forester, Tennessee Valley Forest Managers, Inc., Box 511, Athens, Tennessee.
Territory: Southeastern U. S.
Specialization: 4, 16, 17. Also operational management of forest properties, and custom sawing.

George W. Morrill, Jr., Consulting Forester, 13½ South Spring Street, Concord, New Hampshire.
Territory: New Hampshire, Maine, Vermont.
Specialization: 4, 13, 15, 16, 18. Also landscaping, forest recreation, and beautification.

Allen W. Neff, Consulting Forester, Reed's Ferry, New Hampshire.
Territory: Southern New Hampshire.
Specialization: 4, 13, 15, 17, 18.

A. Z. Nelson, Consulting Forester, New Ipswich, New Hampshire.
Territory: U. S., Canada, Alaska.
Specialization: 2, 4, 8, 11, 16, 17.

New England Forestry Foundation, 3 Joy Street, Boston 8, Massachusetts.
Consultants: Harris A. Reynolds, secretary; Walter L. Koenig, chief forester; J. Milton Attridge, Lyman H. Brigham, Stanley B. Coville, Walter W. Dwyer, Jr., Frederick P. Elwert, Stephen L. Jacobs, Richard B. Johnston, Kenneth E. Jones, William N. Lane, Frederick J. McLeary, Bradford E. Monk, Allan W. Plumb (Affiliate), Donald R. Poppema.
Territory: New England.
Specialization: 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, 18.

New England Silvicultural Service, Reading, Vermont.
Consultant: Fred M. Hunt.
Territory: Central New England.
Specialization: 4, 10, 15, 16, 17, 18. Also management of pine plantations.

Samuel A. Newman, P. O. Box 156, Everett, Washington.
Territory: Washington.
Specialization: 8, 10, 15, 16, 17. Also aerial surveys and forest litigation.

Leon A. Nix, Consulting Forester and Logging Expert, Port Credit, Ontario, Canada.
Territory: Not limited.
Specialization: 2, 3, 4, 6, 10, 13, 15, 16, 17. Also farm woodlot management.

Northeast Forestry Service, 262 Blauvelt Road, Pearl River, New York.
Consultant: Stanley Mesavage.
Territory: Northeast.
Specialization: 3, 4, 10, 11, 15, 16, 17.

Ernest Nutting, Consulting Forester, Box 51, Camden, South Carolina.
Territory: Principally South Carolina.
Specialization: 3, 4, 6, 7, 11, 13, 15, 16, 17, 18.

Wm. B. Osborne, Consulting Forester, 2167 N. W. Marshall Street, Portland, Oregon.
Territory: Western states, British Columbia.
Specialization: 6, 16.

W. R. Owens, Jr., Consulting Forester, 507 North Street, Nacogdoches, Texas.
Territory: Texas, Louisiana.
Specialization: 4, 10, 12, 13, 15, 16, 17, 18.

Charles R. Page, Jr., Forest Land Manager and Consultant, 415 Friar Road, Chattanooga 11, Tennessee.
Territory: Southeastern states.
Specialization: 4, 7, 11, 15, 16, 17, 18.

Penta Post and Treating Co., Tuttle, Idaho.
Consultants: Vernon Ravenscroft, E. L. Williams.
Territory: Idaho.
Specialization: 1, 2, 3, 4, 6, 14, 15, 16, 17, 18, 19.

Pomeroy & McGowin, Forest Managers, Monticello, Arkansas and Chapman, Alabama.
Consultants: L. K. Pomeroy, Julian F. McGowin (S.A.F. Associate Member), Z. W. White, Robert R. Eastment, T. R. Scott, B. F. Griffin.
Territory: Southern states.
Specialization: 4, 8, 17. Also aerial forest surveys.

Pond & Moyer, Inc., Co., Consulting Foresters, 107 Homestead Road, Ithaca, New York.
Consultants: James D. Pond, Chas. H. Moyer.
Territory: New York and Northeast, Latin America; northern hardwoods, spruce-fir, central hagdwoods, tropical woods.
Specialization: 1, 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18, 21.

Prentiss & Carlisle Company, Inc., Timberland Service—Engineers, 107 Court Street, Bangor, Maine.
Consultants: George T. Carlisle, Philip P. Clement, Robert W. Averill, George D. Carlisle, Edward K. Brann.
Territory: United States, Canada.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18.

John G. Rawls Co., Consulting Foresters, 408 Rogers Avenue, Macon, Georgia.
Consultant: John G. Rawls (S.A.F. Affiliate Member).
Territory: Southeast.
Specialization: 10, 12, 13, 15, 16, 17.

Arthur D. Read, Consulting Forester, 308 Riggs Street, West Monroe, Louisiana.
Territory: Southern pine and hardwood region.
Specialization: 4, 15, 16, 17, 18.

Reed Forestry & Equipment Co., Consulting Foresters, Box 102, Smithfield, North Carolina.
Consultant: R. E. Reed.
Territory: Southeastern states; all forest types.
Specialization: 2, 3, 4, 11, 13, 15, 16, 17, 18. Also custom sawing and sale of forestry equipment.

Tom Reimer, Consulting Forester, Albany, Georgia.
Territory: Georgia, Florida, Alabama.
Specialization: 2, 3, 4, 6, 10, 12, 13, 15, 16, 17, 18.

Donald C. Rock, Consulting Forester and Engineer, Box 508, New Paris, Indiana.
Territory: Lake states.
Specialization: 2, 4, 8, 10, 11, 13, 15, 16, 17, 18. Registered professional engineer. Timber cruising is a specialty.

Frank I. Rockwell, Consulting Forester and Landscape Architect, 614 Twelfth Avenue, Brookings, South Dakota.
Territory: Northern and western states, especially Great Lakes and Great Plains regions to West Coast.
Specialization: 1, 3, 4, 5, 6, 7, 8, 9, 14, 15, 16, 17, 18, 19. Also landscape engineering; farm and city forestry; park, farm, and land management, recreational planning.

A. P. Russell, Commercial and Industrial Forester, 11 Maplewood Drive, Sumter, South Carolina.
Territory: Not limited, but principally southern region.
Specialization: 2, 3, 4, 10, 11, 12, 13, 15, 16, 17, 18. Also forest resource surveys for industry, timberland acquisition and sales, contract logging supervising, log scaling and grading.

Sable Mountain Corporation, Rutland, Vermont.
Consultant: Richard C. Rose.
Territory: Central Vermont.
Specialization: 4, 15, 16, 17.

Leslie A. Sample, Consulting Forester, Route 2, Box 237, Shreveport, Louisiana.
Territory: Arkansas, Louisiana, Texas.
Specialization: 3, 4, 5, 6, 7, 13, 14, 15, 16, 17. Also scaling of logs and trees; marking for cutting; stand improvements.

Roy Dale Sanders, Visual Education Technician, Rural Route 6, Evrodale, Brainerd, Minnesota.
Territory: Unlimited.
Specialization: Forester, wildlife technician, photographer. The entire production supervision of 16 millimeter color educational motion pictures, including script writing, direction, photography, editing, and sound supervision. Also production of all types of color and black and white still picture visual education material.

Joseph A. Schmidt, Consulting Forester, 78 Madden Drive, Naval Base 57, South Carolina.
Territory: Southeast.
Specialization: 4, 13, 15, 16, 17. Also growth studies, timber marking and marketing, and agent for timberland owners.

C. D. Schultz & Co., Inc., Foresters and Engineers, Forest Consultants, 946 White-Henry-Stuart Building, Seattle, Washington.
Consultants: C. D. Schultz, R. D. Schultz.
Territory: Oregon, Washington, California mainly; but no regional limitations.
Specialization: 2, 3, 4, 6, 8, 10, 11, 15, 16, 17, 18, 20.

C. D. Schultz & Co., Ltd., Foresters and Engineers, Forest Consultants, 811 West Hastings Street, Vancouver, British Columbia.
Consultants: C. D. Schultz, R. D. Schultz and 18 members of the Canadian Institute of Forestry.
Territory: British Columbia mainly; but no regional limitations.
Specialization: 2, 3, 4, 6, 8, 10, 11, 15, 16, 17, 18, 20.

Thomas F. Schweigert, Consulting Forester, Walloon Lake, Michigan.
Consultants: Thomas F. Schweigert, George E. Young.
Territory: Michigan.
Specialization: 1, 4, 6, 15, 16, 17, 18. Also contract tree planting; registered land surveyor.

James W. Sewall Company, Consulting Foresters, Old Town, Maine and Port Arthur, Ontario, Canada.
Consultants: Frank M. Call, Charles G. Reed, Carleton C. Young, Jr., Theodore C. Tryon (S.A.F. Affiliate Member), John E. O'Donnell.
Territory: Northeast.
Specialization: 3, 4, 5, 8, 13, 15, 16, 17, 18. Also aerial photography.

James R. Simmons, Consulting Forester, 30 Gordon Street, Bel Air, Maryland.
Territory: Eastern states.
Specialization: 2, 3, 4, 10, 11, 13, 14, 15, 16, 17, 18.

Siskiyou Timber Service, 327 S.E. 6th Street, Grants Pass, Oregon.
Consultant: Douglas J. Theno.
Territory: Northern California, southern Oregon.
Specialization: 10, 15, 16, 17.

William R. Sizemore & Co., Foresters and Surveyors, Tallassee, Alabama.
Consultants: William R. Sizemore, J. Woodrow Deason, John H. Ford, Robert K. Boydell.
Territory: Alabama.
Specialization: 2, 3, 4, 8, 10, 11, 13.

Samuel S. Snook, P. O. Box 521, Walterboro, South Carolina.
Territory: South Carolina.
Specialization: 4, 15, 16, 17.

Seymour I. Somberg, Forestry Aids, Manning, South Carolina.
Territory: Southeastern U. S.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 20. Acquisition and management for investors; forest resource surveys for industry.

Southeastern Alaska Forestry, Consulting Foresters and Logging Engineers, Stedman Hotel, Ketchikan, Alaska.
Consultant: Robert S. Tanner.
Territory: Southeastern Alaska.
Specialization: 4, 10, 15, 16, 17.

Southeastern Foresters, Forest Consultants, 234 6th Avenue North, Jacksonville Beach, Florida.
Consultants: Nelson B. Blocker, D. Eric Bradshaw.
Territory: Southeastern U. S.
Specialization: 3, 4, 6, 8, 12, 13, 15, 16, 17, 18. Also timber resource investigations; timberland management; timber and land sales; insurance company representative for loans on forest properties.

Southern Timber Management Service, 930 Second Avenue, North, Birmingham 4, Alabama.
Consultant: John M. Bradley, Jr.
Territory: Southeast.
Specialization: 1, 2, 3, 4, 10, 11, 13, 15, 16, 17, 18. Acting as land agent and forester in charge for private, commercial, and absentee-owned timberlands of all sizes with a complete timber stand improvement cutting and milling operation as a service under contract.

Frank Spearey, Consulting Foresters, Licensed State Land Surveyor, P. O. Box 547, Nacogdoches, Texas. Branch office, Rusk, Texas, George K. Goldsberry in charge.
Territory: Gulf States.
Specialization: 4, 15, 16, 17. All phases of land management.

Everett R. Stanford, Consulting Forester, 409 North Atlantic Boulevard, Alhambra, California.
Territory: Southern California; mountain watersheds, recreational areas.
Specialization: 1, 5, 6, 7, 18. Also forest watershed management, erosion control, mountain forest home sites, forest park planning and management, structural pest control.

T. J. Starker and Son, 3755 Van Buren Street, Corvallis, Oregon.
Consultants: T. J. Starker, Bruce Starker.
Territory: Oregon.
Specialization: 1, 3, 4, 10, 16, 19, 21.

J. F. Stauss, Consulting Forester, Benton, Pennsylvania.
Territory: Northeast and Canada.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18. Also marketing and other forest products; litigation and damage claims.

Fred Stell, Consulting Forester, Route 2, Box 226 B, Arvada, Colorado.
Territory: Colorado, Wyoming, New Mexico, Kansas, Nebraska.
Specialization: 4, 6, 9, 14, 15, 16, 17, 18.

E. A. Sterling, 39 Lake Avenue, Montrose, Pennsylvania.
Territory: General.
Specialization: 3, 4, 6, 13, 15, 16, 17, 18, 19.

Raymond E. Stevens, Consulting Forester, 419 Lyceum Building, Duluth 2, Minnesota.
Territory: Northern parts of Minnesota, Wisconsin.
Specialization: 4, 15, 16, 17, 18.

Charles H. Stoddard, Land Use Consultant, Wolf Springs Forest, Minong, Wisconsin.
Territory: North Central States.

Edward Stuart, Jr., Operating and Consulting Forester, Avalon, Virginia and Hertford, North Carolina.
Territory: Eastern U. S.
Specialization: 2, 3, 4, 10, 11, 13, 14, 15, 16, 17, 18. Also investigations and arbitration of claims; operational management in manufacturing and marketing of forest products.

Erroll Tarbox, Consulting Forester, 3 Carver Street, Sanford, Maine.
Territory: Southern Maine, New Hampshire.
Specialization: 4, 16, 17.

John F. Tillinghast, Consulting Foresters, Clothier, West Virginia.
Consultants: John F. Tillinghast, Marvin Reed.
Territory: West Virginia, eastern Kentucky, western Virginia.
Specialization: 3, 4, 6, 15, 16, 17, 18, 19, 20. Timberlands in coal producing areas a specialty; services available on job basis or on annual retainer fee basis.

J. M. Tinker, B.S.F., Forestry Consultant, 1723 Peachtree Street, N.W., Atlanta, Georgia.
Territory: Southeastern U. S.
Specialization: All phases of forestry. (Registered Forester.)

Donnie P. Todd, Jr., Consulting Forester, Box 486, Route 5, Charleston, South Carolina.
Territory: Southeast.
Specialization: 2, 3, 4, 5, 6, 7, 10, 12, 13, 16, 17, 18. Emphasis on aerial photo techniques. Also agent for absentee timberland owners.

Henry H. Tryon, Consulting Forester, 258 Mountain Road, Cornwall-on-Hudson, New York.
Territory: New York and New England.
Specialization: 3, 4, 10, 15, 17, 18. Also specializing in sprout hardwood region.

Turner and Shannon, Registered Surveying—Consulting Forestry, Colwell-Arnold Building, Kittanning, Pennsylvania.
Consultant: Robert B. Shannon.
Territory: Pennsylvania, New York, Ohio, West Virginia.
Specialization: 2, 4, 15, 16, 17, 18. Also timber damage appraisals; farm appraisals; construction layout.

James M. Vardaman & Company, 204 Seventh Street, Laurel, Mississippi.
Consultant: James M. Vardaman.
Territory: Mississippi, southern Alabama, eastern Louisiana.
Specialization: 16, 17. Also own and operate medium-sized tree farm.

Myron S. Wall, Jr., Consulting Forester, 4612 Fegan Way, Sacramento, California.
Territory: California.
Specialization: 2, 3, 4, 6, 7, 10, 11, 15, 16, 17, 18. Also photo interpretation as applied to logging engineering, cruising, and mapping; timber sale supervision; scaling; and timber dispute arbitration.

Wallace Bros. Timber Service, Consulting Foresters and Jackson Lumber Harvester Operator-Dealer, Butler, Georgia and Chamblee, Georgia.
Consultant: W. G. Wallace.
Territory: Southeast.
Specialization: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18. Also custom or contract logging and sawmilling.

Robert W. Washburn, Forestry Consultant, Route 1, Box 461, Marquette, Michigan.
Territory: Upper Michigan, northern Wisconsin.
Specialization: 4, 15, 16, 17. Also land appraisal. Registered surveyor, State of Michigan.

Edward H. Werner, Consulting Forest Engineer, 1223 - 26th Street, Sacramento, California.
Territory: California, southern Oregon.
Specialization: 3, 4, 10, 16. Also timber and log procurement, timber sale and logging contract specifications, state forest practice act regulations, timber trespass, claims, and acquisition of timber and range lands.

J. Atwood Whitman, Consulting Forester, Glendon, North Carolina.
Territory: Southern states.
Specialization: 4, 15, 16, 17, 18. Also forest damage appraisal, growth analysis, timber type maps, and municipal forestry.

S. A. Wilde, Soils Department, University of Wisconsin, Madison 6, Wisconsin.
Territory: Wisconsin, Minnesota, Michigan, Missouri, Illinois, Indiana, Ohio.
Specialization: 18. Including survey of forest tracts, selection of planting sites, management of forest nursery soils.

Ellwood Wilson, Consulting Forester, Box 305, Knowlton, Quebec, Canada.
Territory: Ontario, Quebec, New Brunswick, Nova Scotia, eastern U. S.
Specialization: 2, 4, 13, 16, 18.

Richard E. Wilson, 126 Kelvin Place, Ithaca, New York.
Territory: Not restricted.
Specialization: 18. Establishment and care of plantations.

J. E. Woodman, Barnett Bank Building, Jacksonville 2, Florida.
Territory: Eastern United States and Canada.
Specialization: 3, 4, 12, 13, 16, 18.

Robert E. Worthington, Consulting Forester, Quilcene, Washington.
Territory: Olympic Peninsula.
Specialization: 2, 10, 15, 16, 17.

James G. Yoho, Consulting Forester, 231 Elm Street, Nacogdoches, Texas.
Territory: Eastern Texas and South in general.
Specialization: 2, 4, 5, 6, 7, 8, 10, 12, 13, 15, 16, 17, 18. Also forest mapping and timber estimating from aerial photographs. Appointments by mail only.

CONSULTING FORESTERS, CLASSIFIED BY STATES

Consulting foresters are listed below according to the state in which each has headquarters.

Alabama
- Glenn O. Antonie
- Pomeroy & McGowin
- William R. Sizemore & Co.
- Southern Timber Management Service

Arizona

Arkansas
- T. F. Grayson and Company
- Pomeroy & McGowin

California
- Charles H. Bunting
- California Foresteering
- Emanuel Fritz
- Hammon, Jensen, and Wallen
- Ludwig Bros.
- Everett R. Stanford
- Myron S. Wall, Jr.
- Edward H. Werner

Colorado
- K. J. Helmick
- Fred Stell

Connecticut
- Connwood, Inc.
- Ralph C. Hawley
- Donald K. Maissurow

Delaware

District of Columbia
- Albert G. Hall and Associates

Florida
- Floyd F. Clark
- Douglas F. Horan
- T. M. Howerton, Jr.
- Joseph C. Kircher
- Southeastern Foresters
- J. E. Woodman

Georgia
- Grover M. Conzet
- Charles F. Evans
- G. E. Knapp
- The Langdale Company
- T. A. Liefeld
- Thomas A. McFarland
- John G. Rawls Co.
- Tom Reimer
- J. M. Tinker
- Wallace Bros. Timber Service.

Idaho
- Penta Post and Treating Co.

Illinois

Indiana
- Consulting Foresters
- Philip C. Meinzer
- Donald C. Rock

Iowa
- C. V. Fisk

Kansas

Kentucky

Louisiana
- Henry L. Bango
- Inman F. Eldredge, Sr.
- Farmcraft Associates, Inc.
- Clarence W. Griffith
- Ralph W. Hayes
- John F. Kellogg
- Frank J. Lemieux
- Fred B. Merrill
- Arthur D. Read
- Leslie A. Sample

Maine
- Philip T. Coolidge
- Norman H. Gray
- Earl M. McChesney
- Prentiss & Carlisle Company, Inc.
- James W. Sewall Company
- Erroll Tarbox

Maryland
- James R. Simmons

Massachusetts
- C. P. Cronk
- New England Forestry Foundation

Michigan
- Forestry Consulting Services
- Thomas F. Schweigert
- Robert D. Washburn

Minnesota
- William T. Cox
- Roy Dale Sanders
- Raymond E. Stevens

Mississippi
- James W. Craig
- Keith Cranston & Associates
- Randle J. Dedeaux
- James M. Vardaman

Missouri

Montana

Nebraska

Nevada
- John M. Crowl

New Hampshire
- John B. Evans
- H. Thorn King
- George W. Morrill, Jr.
- Allen W. Neff
- A. Z. Nelson

New Jersey
- Merton Henry
- Wm. Mollenhauer, Jr.

New Mexico
- W. T. Doherty

New York
- Raymond D. Adolph
- Allen W. Bratton
- David B. Cook
- David S. Findlay
- Edwin H. Francis
- David H. Hanaburgh
- Hiram L. Henderson
- Richard F. Howard
- LeRoy W. Huntington
- David G. Jennings
- Henry S. Kernan
- Paul C. Lemon
- Malcolm A. Milne
- Northeast Forestry Service
- Pond & Moyer, Inc., Co.
- Henry H. Tryon
- Richard E. Wilson

North Carolina
- Thos. W. Alexander
- Milton Applefield
- T. S. Coile
- R. W. Graeber
- Alvin B. Hafer
- Gorham E. Jackson
- Ralph S. Johnson
- Harvey J. Loughead
- Reed Forestry & Equipment Co.
- Edward Stuart, Jr.
- J. Atwood Whitman

North Dakota

Ohio
- E. V. Jotter

Oklahoma

Oregon
- Bigley and Feiss
- Brown and Brown
- Grant and Evans
- G. W. Hult
- R. Wilson Hutchison
- Mason, Bruce, & Girard
- Stuart Moir
- Wm. B. Osborne
- Siskiyou Timber Service
- T. J. Starker and Son

Pennsylvania
- S. Gayley Atkinson
- L. J. Enright
- Reginald D. Forbes
- R. C. Fraunberger
- LeRoy Frontz
- Nathan B. Golub
- Robert Moore
- J. F. Stauss
- E. A. Sterling
- Turner and Shannon

Rhode Island
- Monterey L. Holst

South Carolina
- John R. Allison
- Bishop Brothers
- Jack C. Blakeney
- Lewis M. Boice
- Gordon Bowker
- Lucas M. Dargan
- Giles G. Hall
- James L. Huff
- Robert F. Knoth & Company
- William F. Milliken
- Ernest Nutting
- A. P. Russell
- Joseph A. Schmidt
- Samuel S. Snook
- Seymour I. Somberg
- Donnie P. Todd

South Dakota
- Frank I. Rockwell

Tennessee
- Green's Timber Service
- M. E. Jelley
- Rex D. McCord
- William J. Mills
- W. Morris Morgan
- Charles R. Page, Jr.
- H. C. Scott

Texas
- N. D. Canterbury
- Farmcraft Associates, Inc.
- George M. Fisher
- W. R. Owens, Jr.
- Frank Spearey
- James G. Yoho

Utah

Vermont
- Halsey M. Hicks
- New England Silvicultural Service
- Sable Mountain Corporation

Virginia
- Winslow L. Gooch
- Stuart G. Keedwell
- R. B. Milne
- Edward Stuart, Jr.

Washington
- William A. Eastman, Jr.
- Robert W. Jones
- Samuel A. Newman
- C. D. Schultz & Co., Inc.
- Robert E. Worthington

West Virginia
- John F. Tillinghast

Wisconsin
- George Banzhaf & Company
- Charles H. Stoddard
- S. A. Wilde

Wyoming

Alaska
- Southeastern Alaska Forestry

Canada
- Belanger and Bourget
- John D. Gilmour
- Leon A. Nix
- C. D. Schultz & Co., Ltd.
- James W. Sewall Company
- Ellwood Wilson

Africa
- Nils B. Eckbo

Foresters' Code of Ethics

Adopted November 12, 1948

The purpose of these canons is to formulate guiding principles of professional conduct for a forester in his relations with other foresters, with his employers, and with the public. The observance of these canons secures decent and honorable professional and human relationships, establishes enduring mutual confidence and respect, and enables the profession to give it maximum service.

Professional Life

1. The professional forester will utilize his knowledge and skill for the benefit of society. He will cooperate in extending the effectiveness of the forestry profession by interchanging information and experience with other foresters, and by contributing to the work of forestry societies, associations, schools, and publications.

2. He will advertise only in a dignified manner, setting forth in truthful and factual statements the services he is prepared to render for his prospective clients and for the public.

Relations with the Public

3. He will strive for correct and increasing knowledge of forestry and the dissemination of this knowledge, and will discourage and condemn the spreading of untrue, unfair, and exaggerated statements concerning forestry.

4. He will not issue statements, criticism, or arguments on matters connected with public forestry policies, without indicating, at the same time, on whose behalf he is acting.

5. When serving as an expert witness on forestry matters, in a public or private fact finding proceeding, he will base his testimony on adequate knowledge of the subject matter, and render his opinion on his own honest convictions.

6. He will refrain from expressing publicly an opinion on a technical subject unless he is informed as to the facts relating thereto, and will not distort or withhold data of a substantial or other nature for the purpose of substantiating a point of view.

Relations with Clients, Principals, and Employers

7. He will be loyal to his client or to the organization in which he is employed and will faithfully perform his work and assignments.

8. He will present clearly the consequences to be expected from deviations proposed if his professional forestry judgment is overruled by nontechnical authority in cases where he is responsible for the technical adequacy of forestry or related work.

9. He will not voluntarily disclose information concerning the business affairs of his employers, principals or clients, which they desire to keep confidential, unless express permission is first obtained.

10. He will not, without the full knowledge and consent of his client or employer, have an interest in any business which may influence his judgment in regard to the work for which he is engaged.

11. He will not, for the same service, accept compensation of any kind, other than from his client, principal, or employer, without full disclosure, knowledge, and consent of all parties concerned.

12. He will engage, or advise his client or employer to engage, other experts and specialists in forestry and related fields whenever the client's or employer's interests would be best served by such actions, and will cooperate freely with them in their work.

Relations with Professional Foresters

13. He will at all times strive to protect the forestry profession collectively and individually from misrepresentation and misunderstanding.

14. He will aid in safeguarding the profession against the admission to its ranks, of persons unqualified because of lack of good moral character or of adequate training.

15. In writing or in speech he will be scrupulous to give full credit to others, in so far as his knowledge goes, for procedures and methods devised or discovered and ideas advanced or aid given.

16. He will not intentionally and without just cause, directly or indirectly, injure the reputation or business of another forester.

17. If he has substantial and convincing evidence of unprofessional conduct of a forester, he will present the information to the proper authority for action.

18. He will not compete with another forester on the basis of charges for work by underbidding through reduction of his quoted fee after being informed of the fee quoted by a competitor.

19. He will not use the advantages of a salaried position to compete unfairly with another forester.

20. He will not attempt to supplant another forester in a particular employment, after becoming aware that the latter has been definitely engaged.

21. He will not review the work of another forester, for the latter's employer, without the other's knowledge, unless the latter's connection with the work has been terminated.

22. He will base all letters of reference or oral recommendation on a fair and unbiased evaluation of the party concerned.

23. To the best of his ability he will support, work for, and adhere to the principles of the merit system of employment.

24. He will not participate in soliciting or collecting financial contributions from subordinates or employees for political purposes.

25. He will uphold the principle of appropriate and adequate compensation for those engaged in forestry work, including those in subordinate positions, as being in the public interest and maintaining the standards of the profession.

The Society of American Foresters

The Society of American Foresters is a professional organization of technically trained foresters. It is a democratic, nonpolitical, nonprofit association of over 8,000 members.

As stated in its Constitution, the objects of the Society are to represent, advance, and protect the interests and standards of the profession of forestry, to provide a medium for exchange of professional thought, and to promote the science, practice, and standards of forestry in America.

Membership in the Society of American Foresters is recognition of a man's professional abilities and attainments. No person can acquire such recognition if it is not deserved.

The Society is governed by a president, vice president, and nine other Council members. Policies established by the Council are translated into action programs which are administered by the executive secretary whose office is in the Mills Building, Washington, D. C.

An annual meeting of the Society includes technical sessions arranged by the eleven Divisions which specialize in forest management, silviculture, private forestry, forest economics, forest products, forest recreation, forest wildlife management, range management, watershed management, public relations, and education. Other features of the meeting include sessions on general topics and a joint conference of the Council and Section delegates.

Sections are regional units of the Society. The United States, its territories, and Canada are divided into 21 Sections which elect their own officers, hold meetings, and conduct appropriate projects and activities. Many Sections have subsidiary units called Chapters which hold informal meetings and field trips to acquaint foresters with each other and with local forestry matters.

The JOURNAL OF FORESTRY is a monthly publication of the Society. Other publications include *Forestry Terminology*, *Fifty Years of Forestry*, *Foresters' Manual* (now in preparation), and others.

Through its publications and meetings the Society provides a medium for the exchange of professional information and promotes cooperation among foresters and with those in allied fields.

By encouraging its members to promote the adoption, use, and improvement of forestry practices, the Society endeavors to extend the benefits of good forestry practices to all timberland owners and users of forest products.

Through the operation of committees, by the functioning of Chapters, Sections, Divisions, and the Council, and by expressions of the membership through referendums, the Society helps establish the policies and standards to be observed by professional foresters.

Forestry News

Cliff Succeeds Granger, Assistant Chief Forester

Edward P. Cliff, regional forester for the Rocky Mountain Region, has been named assistant chief of the U. S. Forest Service in charge of national forest administration. He succeeds Christopher M. Granger, who is retiring January 30 after 45 years of service.

EDWARD P. CLIFF
. . . new assistant chief

Donald E. Clark, assistant regional forester in California, will replace Mr. Cliff as regional forester at Denver, taking over the direction of 18 national forests and cooperative work in Colorado, Wyoming, Kansas, Nebraska, and South Dakota.

In his new position Mr. Cliff will handle watershed, timber, range, wildlife, and recreation uses and fire control activities on 150 national forests in 40 states, Puerto Rico, and Alaska.

A native of Heber City, Utah, Mr. Cliff, was graduated in forestry from Utah State Agricultural College in 1931. He started working for the Forest Service that year as a junior range examiner on the Wenatchee National Forest in Washington. Between 1934 and 1939 he was in charge of wildlife management on 20 national forests in Washington and Oregon. During the next five years he served as supervisor of the Siskiyou National Forest at a time when fire control problems were particularly difficult and held a similar position on the Fremont National Forest where he carried on an extensive timber sale and land exchange program.

In 1944 Mr. Cliff was transferred to Washington, D. C. as assistant chief of the Division of Range Management. He became assistant regional forester in charge of range and wildlife for the Intermountain Region, with headquarters in Ogden, Utah, in 1946, and was promoted to his present position January 1, 1950.

Mr. Granger retires from the Forest Service with an outstanding record of achievement. Under his leadership as assistant chief, national forest timber cut has increased from less than a billion board feet in 1935 to almost five billion board feet a year. Recreational use of national forests has increased 60 percent, and total receipts from national forests are ten times as great.

Starting with the Forest Service in 1907, Mr. Granger worked up through the ranks of forest assistant, forest supervisor, assistant regional forester, and regional forester in the Rocky Mountain and Pacific Northwest regions. In 1933 he was selected to organize the Civilian Conservation Corps activities of the Forest Service and in 1935 took over his present work.

Mr. Granger was born in Detroit, Mich., and was graduated from Michigan State College with a degree in forestry in 1907. He served as a major in the army forestry engineers between 1917 and 1919. He has served as president of the Society of American Foresters, as a member of the Oregon State Forestry Board, and as delegate to the third World Forestry Conference in Helsinki in 1949.

He received an honorary doctor of forestry degree from Michigan State College in 1932. Last May he was presented the Department of Agriculture's Distinguished Service Award.

Mr. Clark transfers to the Rocky Mountain Region with firsthand ex-

CHRISTOPHER M. GRANGER
. . . retiring after 45 years

perience in timber, range, and watershed work there, in two other regions, and in the Washington Office.

He entered the Forest Service as a junior forester in charge of timber surveys on the Medicine Bow National Forest in Wyoming in 1924. Later he served as assistant forest supervisor of the Medicine Bow and of the San Juan National Forests in Colorado. In 1930 he became supervisor of the Arapaho National Forest in Colorado and in 1934 was transferred to a similar position on the Cherokee National Forest in Tennessee.

Between 1937 and 1943 he was assistant to the head of the Division of Operation in the Southern Region and senior administrative officer in the Washington office, Division of Operation. For four years he was principal inspector of field activities, working out of the Chief's office. In 1947 he became assistant regional forester in California.

Born in Illinois, Mr. Clark received his B.S. degree in forestry from Michigan State College in 1924.

DONALD E. CLARK
. . . new regional forester

WAYS AND MEANS of developing a forest insect control program for Wisconsin were summed up by a panel during the conference on this subject at the Trees for Tomorrow camp, Eagle River, Wis., October 22 to 24. The three-day session was sponsored by the state conservation department. Panel members, *left to right*, seated, E. B. Hurst, head of the woodlands division, Consolidated Water Power and Paper Company, chairman; Dr. Roy D. Shenefelt, College of Agriculture, University of Wisconsin; Henry Cramer, assistant director, Wisconsin conservation department; standing, Noble Clark, associate director, agricultural experiment station, University of Wisconsin, and Stanton W. Mead, president, Consolidated Water Power and Paper Company.

Lumbermen Elect Veach President

John B. Veach was elected president of the National Lumber Manufacturers Association, at the associations annual meeting in San Francisco, November 10-15. Mr. Veach is president of the Hardwood Corporation of America, Asheville, N. C.

Corydon Wagner, vice president and treasurer of the St. Paul and Tacoma Lumber Company, Tacoma, Wash., and immediate past president of the national association succeeded to the post of Chairman of the Board of Directors. Ralph R. Macartney, Klamath Falls, Ore., manager of the Klamath Falls branch of the Weyerhaeuser Timber Company, was named first vice-president.

Veach has long been identified as a prominent member of the lumber industry. Born in Oil City, Pa., he received his primary education in the public schools of Pennsylvania and later was graduated from Yale University. He served as director and secretary of the National Retail Furniture Association from 1926 until 1935. Since 1935 he has been president of the Bemis Hardwood Lumber Company, Robinsville, N. C. He is also a director of the National Hardwood Lumber Association and a trustee of the American Forest Products Industries, Inc. He served as president of the Appalachian Hardwood Manufacturers, Inc. for 1948 and 1949. During World War II he was deputy lumber coordinator in charge of hardwoods for the U. S. Navy. In that capacity he handled all procurement of hardwoods for the Army, Navy, Maritime Commission, Treasury, and Lend-Lease. In the current defense program Veach is serving as chairman of the Hardwood Industry Defense Committee, chairman of the Office of Price Stabilization Appalachian Hardwood Advisory Committee, member of the Lumber Industry Advisory Committee of the National Security Resources Board, and as a consultant to the chief of engineers, U. S. Army, on hardwood lumber procurement.

Mr. Harry T. Kendall, chairman of the board of directors of the Weyerhaeuser Sales Company, St. Paul, Minn., was elected chairman of the board of directors of the Timber Engineering Company, Washington, D. C., an affiliate of the National Lumber Manufacturers Association. In addition he was appointed chairman of the Activities Committee of the National Lumber Manufacturers Association. Mr. Kendall is a member of the board of directors of the U. S. Chamber of Commerce and is a lumber consultant to the Munitions Board.

Re-elected as officers of the National Lumber Manufacturers Association were the following: Walter S. Johnson, president, Western Pine Association, Portland, Ore., regional vice-president; Hilman Lueddemann, president, West Coast Lumbermen's Association, Portland, regional vice-president; G. H. King, president, Southern Hardwood Producers, Inc., Memphis, Tenn., regional vice-president; E. O. Lightsey, president, Southern Pine Association, New Orleans, La., regional vice-president; M. L. Fleishel, Port St. Joe, Fla., treasurer; and Henry Bahr, Washington, D. C., secretary.

Heiberg Joins Washington Faculty

Prof. Svend O. Heiberg, head of the Department of Silviculture at the New York State College of Forestry has been appointed as Walker Ames Professor of Forestry at the University of Washington during the winter quarter 1952.

Professor Heiberg was born in Denmark and received his forestry training at the Royal Danish Agricultural College in Copenhagen, and the School of Forestry at Yale. He has studied forestry conditions throughout the United States and Europe, and has lectured in Stockholm, Sweden; Oslo, Norway; Oxford, England; and Copenhagen, Denmark.

He is a member of the Society of American Foresters, the Ecological Society of America, and the Soil Science Society of America. He has been chairman of the Forest Soil Section of the Soil Science Society, and of the Division of Silviculture of the Society of American Foresters. He is the author of many articles on silviculture and forest soils.

While at the University of Washington, he will teach an advanced course in forest soils. In addition, he will give several public lectures.

Ellis Wins Anderson Fellowship

Everett L. Ellis, assistant professor of forestry at the University of Idaho has been awarded an Anderson fellowship for the scholastic year 1951-52 at the College of Forestry of the University of Washington. He is working for the Ph.D. degree in forest products. Ellis received his undergraduate training at the University of Washington and his master's degree from Michigan State College. For the past five years he has been on the faculty of the School of Forestry of the University of Idaho.

Super Trees Sought

Our forests may some day be populated with super-trees if investigations now under way by forest research agencies in the South prove successful. According to an announcement by Willis M. Baker, director of the Tennessee Valley Authority's Division of Forestry Relations, TVA has joined in the search for superior strains of forest trees and now has selection and propagation studies under way.

Improved varieties of black walnut are being tested in 107 variety test plantings throughout the Tennessee Valley.

Little has been done to improve the southern pines. The number of seedlings planted each year now averages 200 million. TVA's two forest tree nurseries produce about 20 million pine seedlings a year. As a first step toward developing better seedlings, it is planned to search the nursery seed beds each year for super-seedlings. In each of the next five years, foresters will select loblolly, shortleaf, and white pine super-seedlings at the rate of one for every 200,000 seedlings produced. All super-seedlings will be evaluated at five years and again at ten years. Any that do not continue to show superiority will be removed from the test plots. Similar measurements and ratings will be carried out at 15 years and again at 20 years. By that time possibly one-fifth of the super-seedlings will remain —the very best ones from the standpoint of growth. Each will then represent one in a million in terms of total seedling production over a five-year period. These will be available for seed production, grafting, and breeding experiment.

This study by TVA is part of a southern forest genetics research project being sponsored jointly by public and private research agencies. Coordination is provided by an Advisory Committee on Forest Tree Improvement. Chairman of the committee is Carl Ostrom, Southeastern Forest Experiment Station. Members are D. A. Anderson, Texas Forest Service; E. B. Price, South Carolina Forest Service; G. I. Garin, Alabama Polytechnic Institute; C. M. Kaufman, University of Florida; T. E. Bercaw, Gaylord Container Corporation; P. T. Lannan, West Virginia Pulp and Paper Company; Keith Dorman, Southeastern Forest Experiment Station; P. C. Wakeley, Southern Forest Experiment Station; Floyd Cossitt, U. S. Forest Service; George Hepting, Bureau of Plant Industry, Soils, and Agricultural Engineering; and E. G. Wiesehuegel, TVA Division of Forestry Relations.

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New Appointments At Southern Experiment Station

Appointment of Lewis R. Grosenbaugh as chief of the Division of Forest Management Research of the Southern Forest Experiment Station has been announced by Harold L. Mitchell, station director. Grosenbaugh succeeds Philip R. Wheeler, who has been named chief of the Division of Forest Economics at the same station.

Grosenbaugh received his Master of Forestry degree from Yale in 1936, worked in various capacities on the Ouachita National Forest until 1938, and then became timber management assistant on the Ozark National Forest (1938 to 1941) and on the Florida National Forests (1946). From 1941-1946 he served in the Navy. Since late 1946 he has been at the New Orleans headquarters of the Southern Forest Experiment Station.

Wheeler has been with the Southern Station since 1931 and chief of the Division of Forest Management Research since 1947. In 1946, following four years' service with the Coast Guard, he established and organized the station's Central Ozarks Branch at Harrison, Ark. From 1931 to 1941 he

LEWIS R. GROSENBAUGH

was in charge of computations for the Southern Forest Survey. He holds the degree of Master of Forestry from the University of Michigan. His predecessor as chief of the Division of Forest Economics is William A. Duerr, now with the Washington office of the U. S. Forest Service.

Other personnel changes are:

Herbert H. Muntz, forester at the station's Alexandria, La., branch, will become officer-in-charge of the branch at Birmingham, Ala., succeeding Norman B. Griswold, who has transferred to the Northeastern Forest Experiment Station at Philadelphia.

David Bruce, forester at the Gulfcoast Branch at Gulfport, Miss. will become officer-in-charge there, replacing T. E. Maki, who has accepted an appointment as professor of management at North Carolina State College.

Edward M. Gaines, officer-in-charge of the station's branch in south Alabama and west Florida, will transfer to the Southwestern Forest Experiment Station at Tucson, Ariz. Walt Hopkins, from the branch at Alexandria La. will replace him as acting officer-in-charge.

G. Luther Schnur, forest mensurationist at the Central States Station at Columbus, Ohio, will transfer to the New Orleans Station.

Dr. Paul V. Siggers Retires

Dr. Paul V. Siggers, specialist on tree diseases for the U. S. Division of Forest Pathology, retired in November after 27 years of investigative work with the federal government.

For the past 23 years, Dr. Siggers has served as pathologist in the Gulf States territory, with headquarters first at New Orleans, Louisiana, and later at Saucier, Miss., in cooperation with the Southern Forest Experiment Station. His studies cover the causes and control of a variety of tree diseases, including the two most important ones in the lower South—the brown spot needle blight of longleaf pine and the fusiform canker of slash and loblolly pine. His work on the two disease problems has been widely followed, and his recommended practices are now being used in successfully coping with them throughout the southern pine region. These results and those of other studies have appeared in more than 25 publications in technical and trade journals and as bulletins of the U. S. Department of Agriculture.

A native of Washington, D. C., Dr. Siggers received his B.S. degree in forestry at the University of Michigan in 1912, and his Ph.D. degree in plant pathology at the University of Minnesota in 1939. Prior to his Gulf States assignment in 1928, he served two years in World War I, spent 4 years as pathologist for the United Fruit Co. in Costa Rica, and about 4 years with both the U. S. Forest Service and Division of Forest Pathology in various locations.

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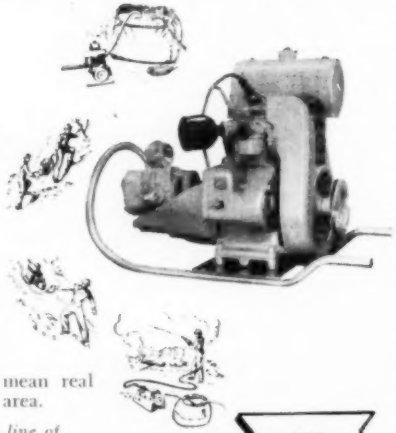

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Trees for Tomorrow Reports Record Camp Attendance

Healthy growth in the high school conservation movement, and increased interest by adult groups in the natural resources problems in Wisconsin are revealed in the 1951 attendance report for the Trees for Tomorrow camp at Eagle River, Wisc.

M. N. Taylor, executive director of Trees for Tomorrow, Inc., said that 767 students from 56 high schools in the state took part in workshops on school time during 1951. In 1949, when the high school programs were inaugurated, 197 pupils attended sessions. There were 504 students in 1950 workshops.

Taylor explained that 1,511 adults visited the camp at Eagle River during the last season, with educators, civic and service organization members, industry personnel, and representatives of public agencies participating in workshop sessions.

Camp workshop staffs are made up of personnel from cooperating groups: U. S. Forest Service, Wisconsin Conservation Department, University of Wisconsin, U. S. Soil Conservation Service, state soil conservation committee, department of public instruction, Wisconsin state colleges, and industry.

Taylor stressed the progress being made in the study of resource management in Wisconsin. He disclosed that, even with spring many months away, the 1952 schedule for high school workshops on school time, from April 5 to June 1, is completely reserved.

Knot Plugging Up-Grades Lumber

A practical method of filling knotholes and defects with clear plugs to raise the grade of lumber is described in a Circular No. 16 issued by the Institute of Forest Products, Seattle, Wash.

The circular, *Knot Plugging to Up-Grade Lumber*, was written for the institute by Ben S. Bryant, instructor in forest products at the College of Forestry, University of Washington.

Mr. Bryant states that knot-plugging is adapted particularly well to the millwork business and to such items as railroad car decking and some furniture. He cites one example where a thousand board feet of a particular shop item could be raised one hundred dollars in value by plugging.

Copies of the circular may be obtained free of charge from the Institute of Forest Products, 303 Anderson Hall, University of Washington, Seattle.

Recent U.S. Forest Service Films

Don't Let It Happen: 16 millimeter, sound; running time, 10 minutes. This is a special version in black and white of the color film, *Then It Happened*, the documentary film of the Maine forest fires, released in 1948. The film is cleared for television.

Three "Smokey Bear" Trailers, cleared for television, combine animated cartoons and live action scenes. All are available in both 16 and 35 millimeter, black and white: *Once Upon a Time*, teaching care with fire in the woods; *It's Up to You*, a direct fire prevention appeal; and *Don't Blame Lightning*, dealing with safety in the woods.

Do It With E's is an in-service training film stressing the three E's of safety—education, engineering, and enforcement; 25 minutes running time, Kodachrome, sound. 16 millimeter.

Only a Bunch of Tools shows recruiting and training volunteer forest fire crews in the Northeast; 26 minutes running time, Kodachrome, sound; 16 millimeter.

Smoke jumpers deals with parachute forest fire fighters. It has been cleared for television; 10 minutes running time, Kodachrome or black and white; sound; 16 millimeters.

Mountain Water shows the function of mountain vegetation in conserving and regulating water; 17 minutes running time, Kodachrome; sound; 16 millimeter.

Avalanches to Order deals with the work of the National Ski Patrol, the Winter Sports Association, and the U. S. Forest Service; 17 minutes running time; Kodachrome or black and white; sound; 16 millimeter; cleared for television.

The Greatest Good is a tribute to Gifford Pinchot and his influence on conservation; 10 minutes running time; Kodachrome or black and white; sound; 16 millimeter; cleared for television.

Cattle and Grass tells the story of western range resources; 15 minutes running time; Kodachrome; sound; 16 millimeters.

River Run shows proper management of private forests on Machias River watershed in Maine; 15 minutes running time; Kodachrome or black and white; sound; 16 millimeters; cleared for television.

Snow Ranger deals with winter recreation on national forests; 15 minutes running time; Kodachrome; sound; 16 millimeters.

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Lumbermen Take Stand on National Conservation Issues

The Board of Directors of the National Lumber Manufacturers Association at its 1951 annual meeting in San Francisco, Calif., adopted as the policy of the national group a number of resolutions presented by the Association's Forest Conservation Committee.

Among the resolutions approved and adopted as policy was a recommendation that the NLMA unite with other groups in opposing federal control of the nation's water resources. The lumber manufacturers also felt that all forestry agencies should place commercial timberlands within their jurisdiction under the most effective management for national participation in the defense effort and it was concluded that a well-planned, economical emergency federal timber access road program is a major need and should be given high priority by government agencies. However, the group also stated that before any timber access roads be authorized, the Secretary of Agriculture or the Secretary of the Interior should cause to be held advisory public hearings on timber access road construction or reconstruction.

The lumber group expressed its opposition to the principle of allocating any current receipts for direct expenditures by federal agencies, thus bypassing the power of Congress to appropriate money.

Also recommended was a state-by-state study of the desirable relationship between federal, state, and private ownership of forest lands with a view to mutual understanding among all classes of forest ownership as to federal and state acquisitions.

NLMA will continue to consider carefully the question of the Hoover Commission recommendations relating to the reorganization of the federal land administering agencies so that action may be taken if deemed desirable when specific reorganization plans are advanced.

Federal flood control and power activities came in for sharp criticism when the lumber manufacturers went on record urging that "the U. S. Department of Agriculture stop using upstream flood survey policies and procedures for insidious propaganda purposes to forward the movement to regulate privately owned farm, range, and forest lands." It was urged that the present upstream policies and procedures be confined to the ascertainment of facts and the elimination of propaganda.

The association recommended that when private forest lands are acquired by the federal government for flood control projects, the private owners should be granted the opportunity of exchanging their lands for suitable and similar federal forest lands. And when private timberlands are condemned by the government, the private owner should have the first opportunity to buy his standing timber. Furthermore, the government should provide access to timber resources located above proposed dams to prevent their being locked up. It was pointed out that these problems are becoming of great importance to the lumber industry.

With regard to timber access roads, the NLMA favors the enactment of federal legislation authorizing $30 million annually for a 5-year period for construction of main-line timber access roads to open up national forests and other federal forests to private lumber and other forest products industries for defense and to improve forest growth conditions on federal forests. With regard to such legislation the group called for annual advisory public hearings for such road programs in each state or region; that such federally financed roads be designed and located chiefly for the purpose of removing timber; that road standards and load limits on such federally financed roads be sufficiently flexible to take advantage of logging opportunities and operating economies; that only such main-line roads be recommended and constructed by the government under the program as cannot be quickly and adequately financed by private timber operators as part of timber sales; and finally that the imposition of charges for use of such access roads by timber operators should be left to negotiation by prospective users of these roads, the government, and cooperative contributors.

The association went on record encouraging the forest pest control councils and other similar private, state, and federal groups in their efforts to secure concerted action on forest insect and disease control. They further urged tree farmers, federal and state forest agencies, and other cooperators to continue and expand their cooperation with the U. S. Bureau of Entomology and Plant Quarantine and develop an adequate detection service and warning service. It was recommended that additional research be undertaken so as to provide a basis for better insect and disease protection on all forest lands and that forest practices on public lands be intensified to salvage wind-thrown areas and insect-killed and threatened timber.

The board favored the establishment of a National Forest Insect and Disease Control Advisory Committee consisting of one representative from the U. S. Department of Agriculture, one from the U. S. Department of Interior, one from the Forest Industries Council, one from the Association of State Foresters, and one representing the general public to be nominated by The American Forestry Association.

Objects to Forest Flooding

Steps to lessen what it terms as adverse effects of the federal multi-purpose dams are proposed by the board of directors of the Chamber of Commerce of the United States.

The board points to damage to the forest economy and to other natural resources in areas adjoining the dams in its adoption of a report by its Natural Resources Committee. The report declared that in acquiring private lands for water projects the government should provide landowners with an equivalent in federally owned forest tracts. The exchange, it was declared, should be at the option of the private owner.

The report pointed out that water projects cause backwater from dams to flood large areas of private forest lands.

"Lumber companies," it said, "to carry on continuous yield cutting must purchase or acquire control of large areas of private forest land so the annual growth over the entire area will equal or exceed the annual cutting rate.

"Any large reduction in the area under sustained yield management through flooding by federal dams will ruin the chain of continuous growth and cutting unless other lands can be acquired to make up for the loss. Not only do dams often flood large areas of forest or range lands, but many times they block access to still larger areas upstream from the reservoirs."

The committee proposed that the government consider as a direct cost to be included in all its water projects the adverse effects of the projects on roads serving as access to forest and other resources. The government, it said, should provide relocated road systems. In many instances, it explained, funds for new access routes are not included in such projects.

Citing harmful effects of water projects on access roads, the committee declared that federal agencies are meticulous in reporting all benefits, both tangible and intangible, but usually ignore adverse effects.

Forest Soils Course University of Washington

Thirty foresters from industry and from public agencies in Washington and Oregon met at the University of Washington College of Forestry in Seattle on November 8, 9, and 10 for a three-day short course in forest soils. The course was similar to the one held in March 1950 on the Charles Lathrop Pack Demonstration Forest at La Grande, Wash. and consisted of both classroom lectures and field studies. The field work was conducted on Lee Forest which is owned by the college and is about twenty miles from Seattle.

The course was under the direction of Dr. Stanley P. Gessel, assistant professor of Forest Soils at the college. In addition to assistant professors Philip G. Haddock of the College of Forestry and Richard B. Walker of the Department of Botany, he was assisted by Dr. Chester T. Youngberg, Weyerhaeuser Timber Company, Centralia; Dr. Warren A. Starr, Washington State College, Pullman; Leo A. Isaac, Pacific Northwest Forest and Range Experiment Station, Portlond, Oreg.; T. B. Plair, regional forester, Soil Conservation Service, Portland; and Ray C. Austin, Crown-Zellerbach Corporation, Camas, Wash.

Those attending the school included representatives from the Crown Zellerbach Corporation; Merrill and Ring; Rayonier, Inc.; St. Paul and Tacoma Lumber Company; Washington Forest Fire Association; Weyerhaeuser Timber Company; U. S. Soil Conservation Service; U. S. Forest Service; and the Washington State Division of Forestry.

Financial Maturity Of Bottomland Trees

When does a hardwood sawlog tree cease to pay its way in the forest and become ripe for cutting?

For the chief bottomland hardwood species, the answer to this question is given in *Financial Maturity of Bottomland Red Oaks and Sweetgum*, by Sam Guttenberg and John A. Putnam of the Southern Forest Experiment Station, U. S. Forest Service.

The publication describes a method by which land managers can determine when their trees are financially mature—that is, when to cut them for the greatest profit. The method applies to any forest type and any system of management, but the examples in the paper are for the sweetgum and red oak trees of the Mississippi River Delta and other large southern river bottoms.

The method consists of determining the rate at which the trees are increasing in value, and cutting those that drop below the rate desired by the forest owner.

To allow the forest manager to judge growth rates quickly and easily, the paper describes and illustrates a system of appraising the vigor of a tree from its bark and crown. Three vigor classes—high, medium, and low—suffice for practical purposes and can easily be recognized by experienced woodsmen.

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James L. Madden Heads AFPI

A New England pulp and paper company executive, James L. Madden, of Boston, is the newly elected president of American Forest Products Industries, Inc. He is president of the Hollingsworth & Whitney Co., with mills in Maine and Alabama.

Mr. Madden succeeds N. F. McGowin, of the W. T. Smith Lumber Co., of Chapman, Ala., as president of the forest industry educational and informational organization. Mr. McGowin remains as a member of the board of trustees.

Other officers of the organization were re-elected for the coming year. They include: William B. Greeley, of Seattle, chairman of the board; Walter J. Damtoft, Champion Paper & Fibre Co., Canton, N. C., and Clyde Martin, Weyerhaeuser Timber Co., Tacoma, Wash., vice-presidents, and P. H. Glatfelter, P. H. Glatfelter Co., Spring Grove, Pa., treasurer.

The new AFPI officers were named at the annual meeting of the board of trustees held in Washington, D. C., Nov. 2.

Shipman Wins Fellowship

Robert D. Shipman, graduate fellow at Michigan State College, East Lansing, has been appointed to an Alumni Pre-Doctoral Fellowship in Forestry for the academic year 1951-52. Mr. Shipman was formerly employed as an agricultural aide by the Lake States Forest Experiment Station (Lower Peninsula) with headquarters at East Lansing. He received his undergraduate forestry degree at the University of Michigan and is now a candidate for the Ph.D. degree in Forestry at Michigan State College. The fellowship award was granted to him as the top award in a large field of applicants.

Opportunities for Study In Tennessee Valley

A bulletin recently prepared by the Board of Control for Southern Regional Education deals with off-campus opportunities for graduate and professional education in the Tennessee Valley Authority. In forestry, it lists the general fields of investigational work being done by TVA's Division of Forestry Relations and the action programs offering opportunities for students and faculty.

Included among the possible subjects for these are: analysis of growth and yield of plantations; hardwood reproduction; hardwood significance in hardwood-cedar types; soil moisture; qualitative measures of tree transpiration; form variation in plantations; fiber length and wood density in relation to site conditions; characteristics of nursery soils as related to production; use of herbicides; ecological succession from farm to forest; and industrial wood waste.

Similar opportunities are shown for other phases of TVA's program. The booklet is available from the Board of Control for Southern Regional Education, 830 Peachtree St., N. W., Atlanta, Ga.

George F. Cornwall, "Timberman" Editor Dies

George F. Cornwall, 58, editor of *The Timberman* magazine, died of a heart attack in Victoria, British Columbia, on November 7. He was returning from the Pacific Northwest Logging Congress.

Recognized as a leading spokesman for the Northwest timber industries, Cornwall was also a leader in conservation movements. He had been managing editor of *The Timberman* for 25 years, and became editor in 1950 following the death of his father who founded the magazine more than 50 years ago. In 1934 he traveled with the Oberlaender Foundation Study group to observe forestry in Europe.

Six Southern Colleges Sign Educational Compact

Six colleges and universities in the South having accredited schools of forestry have signed a memorandum of agreement on forestry training and research. Through this agreement these institutions provide for joint planning and cooperative action to supplement each other's contribution so that the total program can effectively meet the needs of the region.

The agreement was brought about by the Board of Control for Southern Regional Education, Atlanta, Ga. This board has been established by compact of 14 southern states in order to provide for interstate collaboration in education. Because of the importance of forestry in the South, the board several years ago created a Commission of Forestry Training and Research of which Dr. C. F. Korstian of Duke University is chairman.

The following institutions having accredited schools of forestry are signatories to the agreement: Alabama Polytechnic Institute, Duke University, Louisiana State University, North Carolina State College, University of Florida, and University of Georgia.

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Lengthening Ship's Planking Saves Navy Funds and Copper

A hull designer, a lumberman turned naval officer, and a forest products engineer have teamed up to perfect a simple idea to effect material savings of critical copper and Navy funds.

The idea is to increase the length of planking used on naval vessels and thus to reduce the number of fastenings between the timbers. It was originated by A. M. Johnson of the Hull Design Branch, Navy Bureau of Ships. Practical aspects were worked out by Naval Reserve Lieutenant Joseph L. Noyes, an engineering officer attached to the bureau, and John G. Kuenzel, a forest products engineer in the bureau.

Basically, the plan consists of adopting glued scarf—or notched—joints in the specifications for planking wooden minesweepers. A vertical V scarf will be used. It is made by a new scarfing machine which employs the principle of the gang saw. Adhesives of an intermediate setting type, durable in salt water, will be used.

Instead of using only solid members in planking wooden ships, shipbuilders will be encouraged to use the new scarfed material, which can be furnished in any lengths. More than 5,000 mills can furnish shorter lengths for scarfing, while only about 50 mills can furnish longer lengths.

In wooden minesweepers built with a 24-foot lineal average planking, there are approximately 996 butt joints, each of which costs roughly $10. If the length of the planking is increased to 32 feet—as Lt. Noyes and Mr. Kuenzel envisage—about one-third of these butt joints will be eliminated, thus saving nearly 2,000 silicon bronze fasteners per vessel. A $3,320 saving per vessel will be realized in planking installation alone, through reduced material and labor costs.

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Wisconsin County Forests

Two decades ago the 2,000,000 acres of Wisconsin county forests were cutover lands that no one wanted. Now, under fire control and forest management, they are paying off in several directions, according to F. G. Wilson, state supervisor of cooperative forestry.

1. Stabilization of watersheds and clear, cold streams for trout, a highly expensive objective elsewhere, are incidental results.

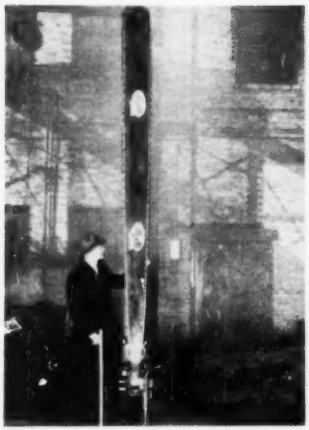
2. They meet the growing demand for recreational forests, with many miles of streams and lake shore.

3. They constitute the largest class of public hunting grounds in the state. Dense young plantations provide cover for game birds and animals during snow or sleet storms. Timber sales lead to cutting which create desirable openings and edge for wildlife.

4. The county forests set examples of good forest management and lead other land owners to adopt better forestry practices.

"But these multiple use values are only the frosting on the cake," says Wilson, who has worked with the counties since the beginning of this program. "These extensive properties must repay the counties for the uncollected taxes which they represent. They must provide local employment in the woods and contribute raw material for industry. The forester, like the farmer, will be judged by the harvest."

Wilson's staff of 15 foresters serves the 27 counties in planning the reforestation program and there are now 80,000 acres of successful plantations. They also drafted the cutting specifications for the 589 timber sales completed in 1950 which yielded 3,972,000 board feet of saw logs and 83,500 cords of pulpwood and brought a gross income of $250,000 to the counties.



ONE OF THE LARGEST guide plates and cutting chains ever made for use on power chain saws is shown above. Designed by the Mall Tool Company, this gigantic saw has a 12 foot chain guide plate and cutting chain. The guide plate is interchangeable and can be detached from the power unit when smaller sizes are desired.

Pocket Gopher Effects On Oregon Meadow Ranges

Control of the Dalles pocket gopher is sometimes necessary to improve mountain meadow ranges in poor condition, according to Circular 884 recently issued by the U. S. Forest Service.

The 36-page booklet, *The Dalles Pocket Gopher and Its Influence on Forage Production of Oregon Mountain Meadows* was jointly prepared by A. W. Moore, biologist for the U. S. Fish and Wildlife Service and Elbert H. Reid, assistant chief, Division of Range Research of the Forest Service.

The authors, during a 17-year cooperative study between the two bureaus, conducted their investigations on two adjacent mountain meadows in the Blue Mountains of eastern Oregon. They set up a grazed and ungrazed experimental plot on both meadows.

At the beginning of the study both meadows were in poor range condition and pocket gophers were abundant. Between 1931 and 1940 gophers were removed from one meadow while they were allowed to remain on the other. In 1940 the men reversed the treatment. Gophers were removed from the gopher-infested meadow and transplanted onto the first meadow at the rate of 16 to the acre. This set-up was maintained through 1948.

Moore and Reid found that the pocket gophers on the gopher-infested meadow prevented range improvement between 1931 and 1940. In 1940 the grazed portion of the meadow was about the same as at the start of the study and the ungrazed portion was poorer, being dominated by tarweed, a low-value annual weed.

During the same period vegetation improved on the gopher-free meadow —progressing from vegetation dominated by perennial weeds to one dominated by perennial grasses and weeds.

When the mountain meadows were given reversed treatment and pocket gophers placed on the formerly gopher-free area, that meadow continued to increase in forage production. During the 8-year period between 1940 and 1948, its grazing capacity doubled. Greater improvement occurred following the removal of the gophers on the area not freed of gophers until 1940. Its grazing capacity increased 5.7 times.

Art Sells Forestry

Eighteen Louisiana artists won a total of $2,100 in cash prizes in the First Louisiana Forestry Art Exhibition sponsored by the Louisiana Forestry Commission and the Louisiana Art Commission.

All paintings were either the conventional or abstract interpretations of forestry or forest industry submitted by professional artists, adult amateurs, and college, high school, and elementary school students.

Representing the first time two state agencies have joined hands on a common project in Louisiana, the contest was held to promote interest in forestry through the medium of art. Co-directors were James E. Mixon, state forester, and Jay Broussard, director of the Louisiana Art Commission.

An exhibition of the prize winning paintings and several other selected paintings entered in the contest was presented at the annual meeting of the Society of American Foresters, Biloxi, Miss., Dec. 12 through 15. The paintings will be sent throughout the state for private exhibitions during 1952.

Cotton State Joins Keep Green

A Keep Green banner was raised over Alabama at a state-wide forest fire prevention rally held in Montgomery, October 30, 1951.

The forest fire prevention campaign is sponsored by the Alabama Forest Products Association with the cooperation of more than 30 other civic, industrial and public groups.

Alabama is the nation's thirty-first Keep Green state and the South's tenth. Two other states—Tennessee and Arizona—have joined the parade of Keep Green states during 1951.

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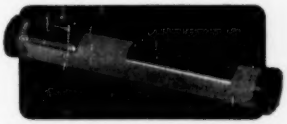

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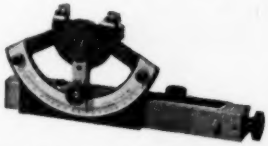

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Florida Forestry Council Meets, Elects New Officers

The fall meeting of the Florida Forestry Council, held in Lake City, November 16, 1951 featured fire prevention and law enforcement and research directed toward increasing timber growth. Dr. C. M. Kaufman, director of the School of Forestry, University of Florida, discussed cooperative research leading to reforestation of areas of low grade hardwoods with southern pines. The U. S. Forest Service, Florida Forest Service, and the School of Forestry are cooperating in the project.

E. L. Demmon, director of the Southeastern Forest Experiment Station, reported on an integrated program of timber production and grazing now being studied in several Florida counties. Forest fire problems were discussed by C. H. Coulter, state forester, and Joe Schuck of the Florida Forest Service.

J. E. Woodman of Jacksonville, industrial consulting forester was elected chairman of the council. Other officers are: Seaman K. Hudson, vice-chairman, Container Corporation of America, Fernandina; and Professor Charles G. Geltz, secretary-treasurer, Florida School of Forestry, Gainesville.

Sawmill School Well Attended

Sixty sawmill and other timber industry operators attended the University of Tennessee sawmill conference at Sewanee, October 24. Total attendance was 106. Cooperating with the university in planning and conducting the conference were Appalachian Hardwood Manufacturers, Inc., University of the South, Tennessee Division of Forestry, Tennessee Valley Authority, Corley Manufacturing Company, and Corinth Machinery Company. The conference was held at the University of the South sawmill.

W. N. Darwin of TVA's Division of Forestry Relations analyzed the operation of small sawmills, using information collected in a recent TVA study of circular sawmills in the Tennessee Valley. He pointed out how production can be stepped up and how costs can be reduced, and outlined a formula by which sawmill men can rate the efficiency of operations.

Grover Rann, a lumberman and chairman of the Tennessee Conservation League's forestry committee, led the discussion following Mr. Darwin's presentation. Ernest Clevenger of the Corley Manufacturing Company and A. F. Ray of Corinth Machinery Company conducted a clinic on the operation and maintenance of sawmill equipment. Carl I. Peterson, state forester of Tennessee, and Dr. B. S. Pickett, head of the Department of Horticulture and Forestry, University of Tennessee, summarized the day's discussion. General chairman for the meeting was Charles E. Cheston, head of the Department of Forestry and Engineering, University of the South.

Steinbrenner Wins Weyerhaeuser Fellowship

The appointment of Eugene C. Steinbrenner to the Weyerhaeuser Fellowship in forest management has been announced by Dean Gordon D. Marckworth of the College of Forestry, University of Washington. Steinbrenner, who is working toward the doctor of philosophy degree in forest soils, received his undergraduate training at the University of Minnesota and his master's degree in forest soils from the University of Wisconsin.

This is the third award which has been made under the grant from the Weyerhaeuser Timber Foundation. The first was in 1949 to Myron Savage who is now employed by Rayonier, Inc. at Hoquiam, Wash. The second award was made in 1950 to Paul E. Bruns who is assistant professor of forestry at Montana State University.

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Hursh to Study Forest-Climate Relationships in Africa

The Department of State has awarded Dr. Charles R. Hursh of the Southeastern Forest Experiment Station, Asheville, N. C., a Fulbright Fellowship to conduct scientific research in British East Africa, where he is to study the effect of forests and forest removal on the local climate and water resources of East Africa. As a senior research scholar he will be associated for nine months with the East African Agricultural and Forestry Research Organization, Kikuyu, Kenya. This organization serves the Colony of Kenya, and the British protectorates of Uganda and Tanganyika.

Dr. Hursh is already known internationally for his contributions to the field of land-use hydrology and forest influences. Both of these fields of science are highly pertinent to the land development program of British Commonwealth in Africa. The influence of forests on the climate and water supply of British East Africa is a subject of much importance to the agricultural development of the region. Complete clearing of the coastal forests along the Indian Ocean is thought by some observers to have had an unfavorable effect on both the coastal rainfall and the rainfall of the interior. Also repeated burning of the interior savannahs and the brush and thorn vegetation has been practiced for many centuries by the dense native population.

CHARLES R. HURSH

Various farmers associations have called upon the local government to adopt strong policies of forest conservation and forest planting. Differences of opinion exist as to what should be the desirable policy in such programs. Very few specific data are available, but where eucalyptus plantings have been used in the moderate rainfall belt in the Transvaal, it has been reported that stream flow has been definitely reduced and some springs have stopped flowing.

There still exists a wide difference of opinion among scientific groups in British East Africa as to the practical effects of forests on the local climate and water resources. Dr. Hursh's research and observations will be directed toward collecting and interpreting information pertinent to a better understanding of the existing forest influences problems of the country.

Dr. Hursh went to Asheville as a member of the Forest Service in 1926, and is now the chief of the Division of Watershed Management Research of the Southeastern Forest Experiment Station. He has been associated with the early erosion and flood control programs of the Department of Agriculture, and has had charge of the technical direction of the Coweeta Hydrologic Laboratory since its establishment in 1933. He is a member of the American Geophysical Union, the Society of American Foresters, the Soil Science Society of America, and is also a committee member of the Highway Research Board of the National Research Council.

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Forestry Employment

S.A.F. members wishing the Journal's assistance in securing forestry employment are privileged to insert from one to three, consecutive, 60-word advertisements in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiation.

Positions Wanted

Forester, B.S.F. and M.F.; 27, married, 2 children; experience in sawmills, woodland management, job supervision, and pulpwood procurement; desires job in management or utilization in the Northeast. S.A.F. Junior Member.

References and detailed information on request. Allen W. Neff, Reeds Ferry, N. H.

Graduate forester, twenty years' experience in private and public forestry, desires to locate in South Atlantic or Gulf states with progressive forest industry. Especially familiar with the production and procurement of poles, piling and cross-ties, and the management of slash and longleaf pine. References and detailed information on request.

Box G, Journal of Forestry, Mills Building, 17th St. at Pennsylvania Ave. N. W., Washington 6, D. C.

Forester, B.S.F. 1950 graduate, 30 years old, single, desires position with company located in the eastern part of the country. Experienced in surveying, timber cruising, and chemical spraying. References and details upon request.

Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

B.S.F. 2½ years of well-rounded experience in forest management and fire control as public service forester. Desires opportunity to put forestry into practice on lands of interested company, with chance to learn other aspects of private forestry. Chances for advancement and future outlook are main objectives; salary is important (have family of three) but secondary.

Box K, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 38 now employed in private industry; a logging and woods products operation. Six years with present concern. Desire to relocate for better opportunity. Prefer private industry. Experience includes logging, aerial photographic mapping, administration of logging contracts, reforestation, stand improvement work, growth studies, surveying, personnel labor relations, timber appraisal, insect, disease and fire control work. References and details upon request.

Box M, Journal of Forestry, Mills Building, Washington 6, D. C.

Forestry graduate, B.S.F., 27 years old, married, no children, desires position, preferably in park work, research, city park or forestry department. Experience with U.S.N.P.S. and U.S.F.S. Several U.S. Civil Service grades. Member S.A.F. Excellent for public contact. References and detailed information on request.

Box O, Journal of Forestry, Mills Building, Washington 6, D. C.

Forestry graduate, B.S.F., in general forestry, M.F. with major in wood utilization, 4 years experience administering timberlands. World War II veteran, age 33, married with two children. Desire position in research in wood utilization but qualified for work in timberland management. References and detailed information upon request.

Box R, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 26, married, veteran, desires permanent forestry position. Diversified experience in wood procurement and management fields. Junior member of S. A. F. References and details on request.

Box T, Journal of Forestry, Mills Building, Washington 6, D. C.

Position wanted with forest industry in West. B.S.F. Colorado A&M College 1941, M.F. Duke University 1943. Age 32. Training and experience in forest management, land use planning, industrial management, development of improved processes and procedures, public information, administration.

Robert D. Hostetter, 6918 Standish Drive, Radiant Valley, Hyattsville, Maryland.

Positions Available

A client of mine, establishing a new pulp and paper operation in Northern Quebec is desirous of employing a top flight Forester. His duties would be to organize from scratch, a forestry division to procure pulpwood both on the open market and on company lands through company and/or contractor log, ing operations. He would also be in charge of forest management of large timber holdings. At first he would be retained as a consultant and if he proved satisfactory, a long term contract would be negotiated.

Qualifications should include a forestry degree plus years of practical pulpwood experience, preferably in Eastern Canada. It is desirable but not necessary, that he be bi-lingual, French and English. His home would be in a small company town in the bush. Age between 30 and 50 and obviously fit. Canadian citizens will be given preference.

Send complete resume and salary requirements. If chosen for interview, expenses would be paid to New York City, or a representative will visit applicant. All negotiations will be kept in strictest confidence. Please list names of several references.

Robert C. Fronmberger, Forest Products Business Consultant, 418 Park View Drive, Wynnewood, Penna.

Wanted technical foresters between the ages of 21 and 32 to fill positions as county foresters in a southern state. Duties include fire control, management, reforestation, and public relations. Excellent advancement opportunities in an expanding organization. Immediate placement.

Box L, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester with experience in cruising hardwoods along the Gulf Coast. Excellent future for right man. Write giving detailed information and references; also salary expected.

Box 765, Albany, Georgia.

Wanted hardwood lumber grader and hardwood lumber salesman for a well-established firm in northern Ohio. If you are interested, write **Ohio Forestry Association, Southern Hotel, Columbus, Ohio**

Recent forestry graduate for assistant forester's job in timber management. Prefer man with family. Location Southeast Oklahoma.

Details on request. Box S, Journal of Forestry, Mills Building, Washington 6, D. C.

Georgia Foresters Registered

Early reports on the registration of foresters indicate that more than 125 foresters have been approved by the board of registration. These include consultants, industry employees, state, federal, and school men. In addition to residents of Georgia, there are many included from nearby states, and a few from distant states, who wish to certify their work as being done by a "registered forester." It is reported that about 36 applicants for registration have been turned down by the board.

Graham, New Assistant SCS Chief

Dr. Edward H. Graham has been appointed assistant chief of the Soil Conservation Service to head up the overall cooperative programs of the service. Until his new assignment, Dr. Graham was chief of the biology division of the service. He is the author of numerous publications, both scientific and popular, in the field of conservation. His *Natural Principles of Land Use* is a standard text book of soil conservation.

Hardwood Log Grading School

The largest enrollment of private industrial representatives at any hardwood log grading school ever held in the South was present in Lufkin November 6-9, according to Gene Marshall, head of the Forest Products Department of the Texas Forest Service. Out of a total of approximately 40 enrollees, three-fourths of these were industrial foresters and lumbermen. The course, the 19th held in the South, was conducted in cooperation with the Southern Forest Experiment Station and endorsed by the Texas Lumber Manufacturers Association.

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EAGLE
DUO-HYDRAULIC
TREE MARKERS
quick and easy to operate

Pick your tree, press the trigger lever on the Eagle Duo-Hydraulic Tree-Marking gun . . . swish—the tree is marked! That's all there is to it. The paint sprays freely; no clogging parts. Easy to take apart and clean because of simple mechanism. Guaranteed against leaking. ¾, 1 and 2 pint capacities.

FOR SPECIAL NUMBERING JOBS
USE THE *EAGLE* SUPER #66

Easy to operate — All brass, piston-type gun. Takes undiluted but strained outside paint. Tree-tested on 40,000 trees in Lake states region.

Order from your Supply Dealer or write for more information to

MANUFACTURING COMPANY Wellsburg, West Va.

Mack "Quality First" Products
for the safe handling of Pulpwood and Ties

Mack GRAPPLES

All-welded steel, combine light weight with rugged strength

Four standard sizes

MACK WELDING CO.
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SEEDS FOR NURSERYMEN

TREE — SHRUB — PERENNIAL —
FLOWER — VEGETABLE

Correspondence with Seed Collectors Invited

HERBST BROTHERS
Established 1876

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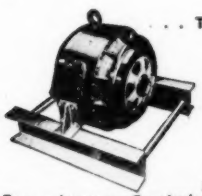

. . . TWO IN ONE

TORCON

TORQUE CONVERTER AND HYDRAULIC COUPLING

Simple Construction—Extremely rugged—Easy maintenance—Completely hydraulic—No mechanical connection—Automatic adjustment—No pressure on oil seals—Minimizes load shocks—Self-lubricating—Hydraulic fluid—SAE 10 Turbine Oil

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SOUTHERN GLO TIMBER MARKING PAINT

White—Yellow—Red—Blue

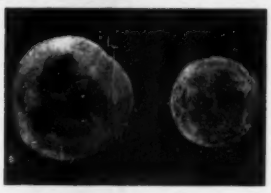
Still available for immediate shipment, both paste and ready mixed. Write for prices and literature. Order direct from factory.

SOUTHERN COATINGS AND CHEMICAL COMPANY
SUMTER, SOUTH CAROLINA

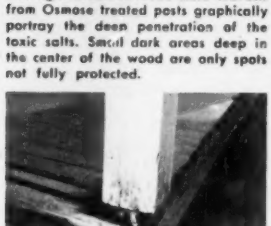
HERE'S PROOF *that* OSMOSE TREATED LUMBER *Lasts Longer*

The board at the left is a piece of Osmose treated Lumber and was subjected to severe exposure tests. Upon examination it was found to be strong and healthy, unaffected by fungi or wood destroying insects.

This piece of ordinary, untreated lumber was subjected to identical exposure tests and the difference in appearance speaks for itself. This board had lost most of its natural strength, crumbled in the hand and was practically consumed by pests that habitually attack unprotected wood.



The light areas in these cross sections from Osmose treated posts graphically portray the deep penetration of the toxic salts. Small dark areas deep in the center of the wood are only spots not fully protected.



Here's what happens when you build with untreated lumber that is subjected to moisture. This porch built directly on the ground would have lasted 3 to 5 times longer if it had been constructed of Osmose treated Lumber.

★ ***WON'T ROT!***
★ ***REPELS TERMITES!***
★ ***LASTS 3 TO 5 TIMES LONGER!***

Men who know lumber also know that lumber doesn't just wear out . . . it is literally "eaten up" by fungi and hordes of wood destroying insects. However, Osmose treated Lumber stops these pests cold! Osmose treated Lumber is ordinary lumber that has been treated with Osmosalts (a highly toxic chemical mixture) that makes it resistant to decay and termites.

Naturally, the user pays a small premium for Osmose treated Lumber, but when you consider that it lasts 3 to 5 times longer, is fire retardant and NEED NOT BE PAINTED, the use of untreated lumber appears impractical indeed. Osmose treated Lumber, unpainted, is ideal for modern ranch-type houses, cottages, barns, outbuildings, bridges and all types of industrial construction. If you prefer, Osmose treated Lumber can easily be painted and the green treatment color acts as a base coat, thereby saving on paint.

Everything we say about Osmose treated Lumber has been proven over and over again during the past 15 years by our users as well as the Federal Government who have made exhaustive tests. Proof of these service tests is on file and you may have copies by writing to our headquarters. Osmose treated Lumber is sold through Authorized Producers whose operations are supervised and directed by graduate foresters trained specially by the OSMOSE WOOD PRESERVING CO. OF AMERICA, INC., 1437 BAILEY AVE., BUFFALO 12, N. Y.

OSMOSE TREATED LUMBER